While we are getting started...

We would like to hear from you! In the chat please share:

When you hear the phrase nature-based strategies, what comes to mind?

Agenda:

1. Foundations
2. Habitat protection
3. Green & grey
4. Shoreline stabilization
5. Case studies
6. Getting out of harm's way
7. Questions

Meeting Reminders:

- This meeting is being recorded, if you would like to keep your camera off
- Please mute your audio when you are not talking
- Feedback is appreciated!

Natural Hazards 101 Series

Session #6: Demystifying Nature-Based Strategies

February 25, 2025

Riparian Buffer

Institute of Natural Resources

Rain garden and bioswale

City of Vancouver, CAN

Barrier island

NC Coastal Land Trust

Plant restoration

NOAA

Permeable pavers

R.I. Lampus

Natural materials in erosion control

Ashley Charleson / Brunswick, ME

Similar terms you may hear…

- Nature-based solutions
- Green infrastructure
- Engineering with nature
- Nature-by-design
- Nature-based engineering
- Living shorelines
- Natural climate solutions
- Low impact development
- Eco-design

Definition

Actions for our natural and built environment

that address

societal challenges

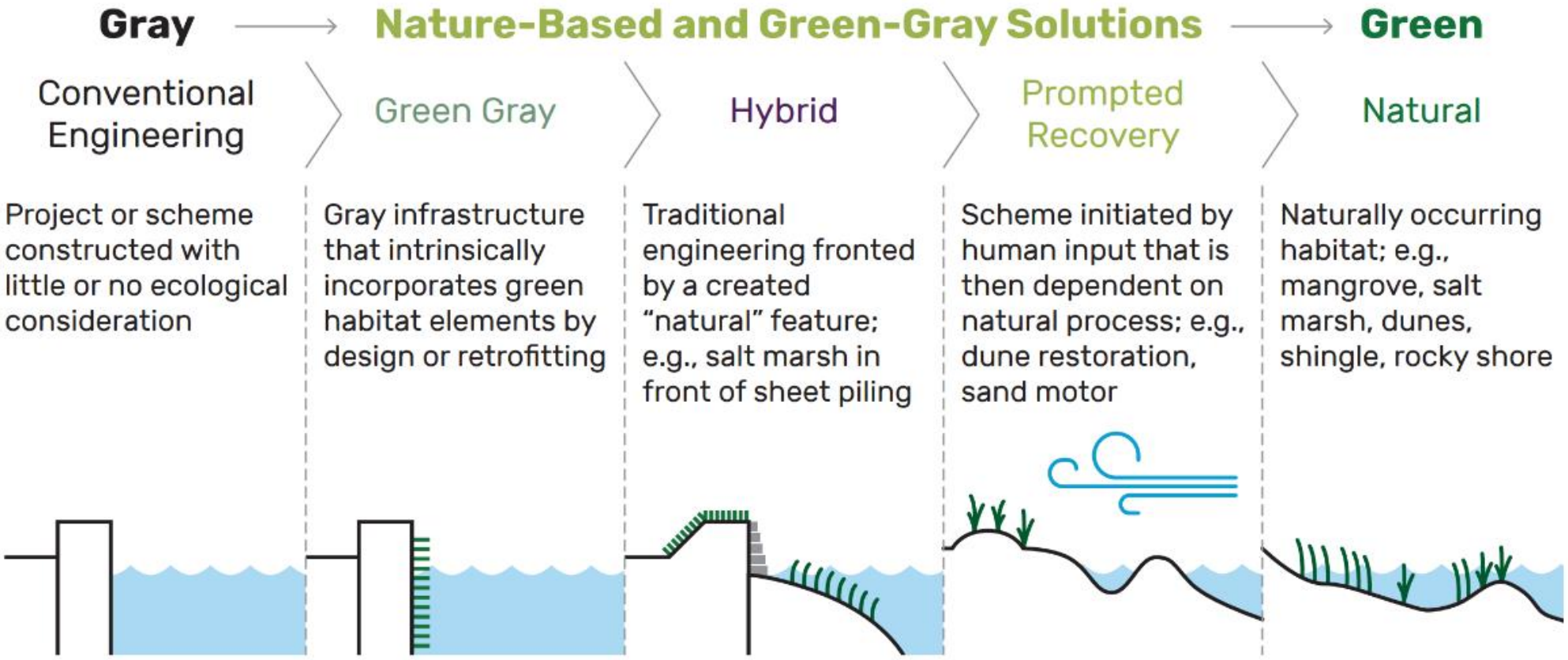
i.e., natural hazards

While benefiting both humans and nature

Grade, A.M., A.R. Crimmins, S. Basile, M.R. Essig, L. Goldsmith, A.R. Lustig, T.K. Maycock, A. McCarrick, and A. Scheetz, 2023: Appendix 5. Glossary. In: *Fifth National Climate Assessment*. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. https://doi.org/10.7930/NCA5.2023.A5

General Framework: From US Army Corps of Engineers

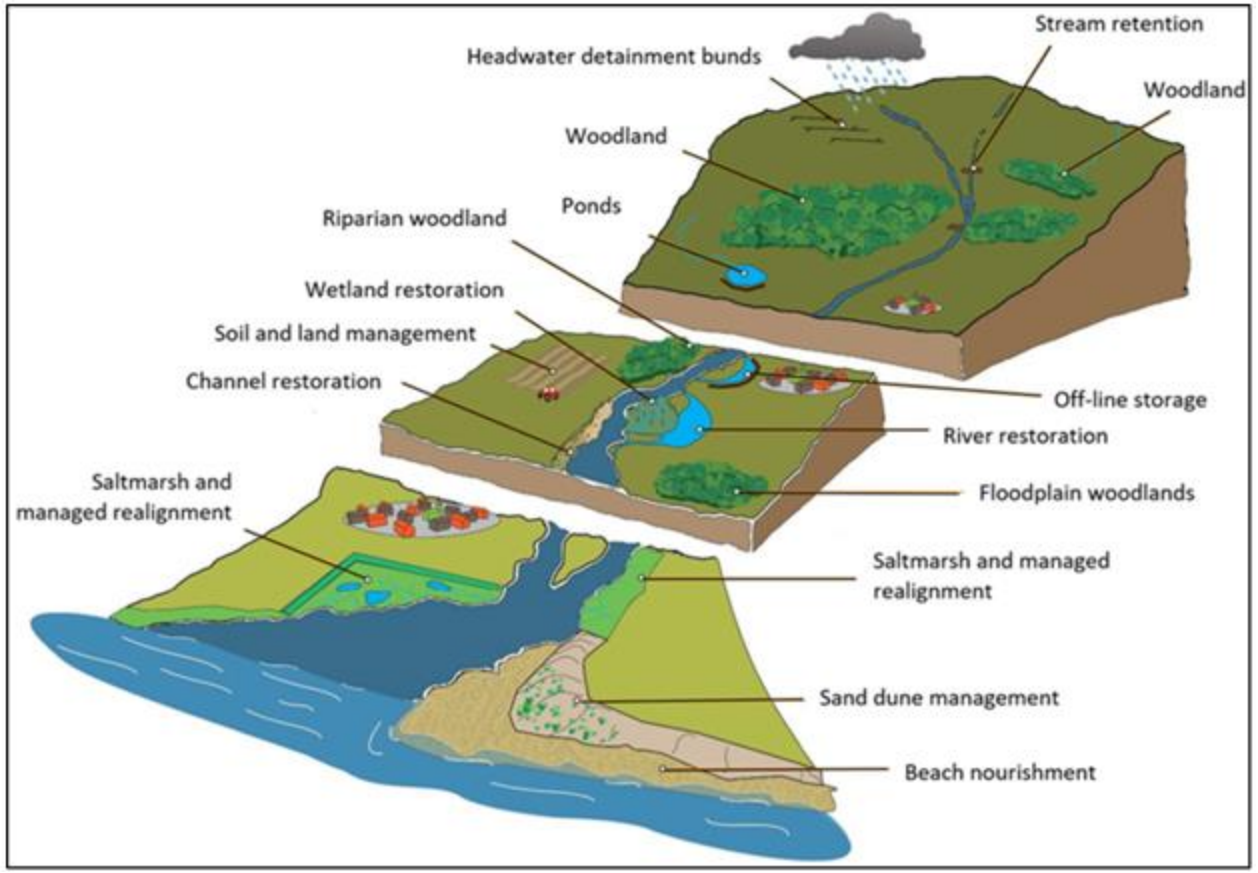
Figure 14.5. ***Continuum of Nature-Based Techniques Used in Practice, from Simple Additions to Existing Infrastructure to More Elaborate Schemes Incorporating a Suite of Nature-Based Elements***



Bridges, T. S., J. K. King, J. D. Simm, M. W. Beck, G. Collins, Q. Lodder, and R. K. Mohan, eds. 2021. International Guidelines on Natural and Nature-Based Features for Flood Risk Management. Vicksburg, MS: U.S. Army Engineer Research and Development Center. p. 707.

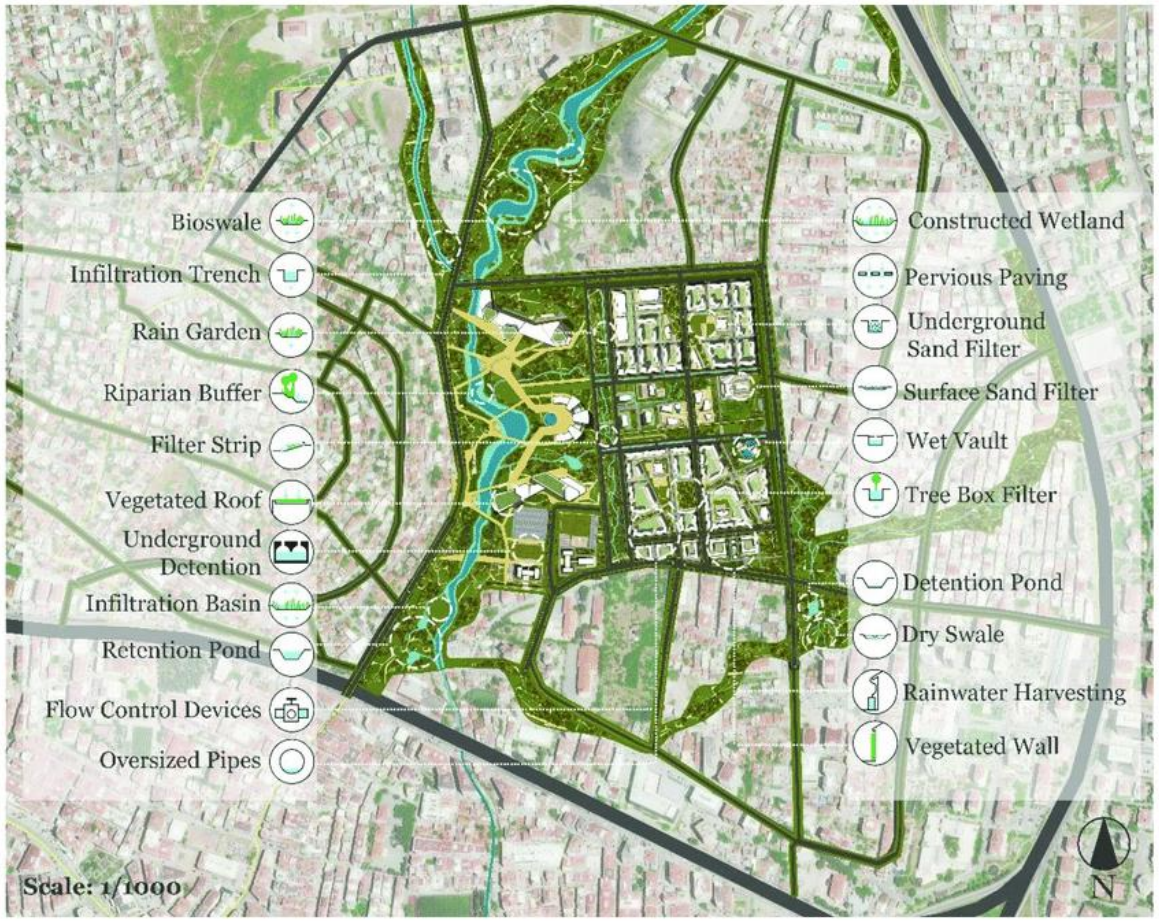
Regional Nature-Based Strategies

- Connectivity of nature and the water cycle
- Site specific vs. system-wide
- Incremental vs. transformational

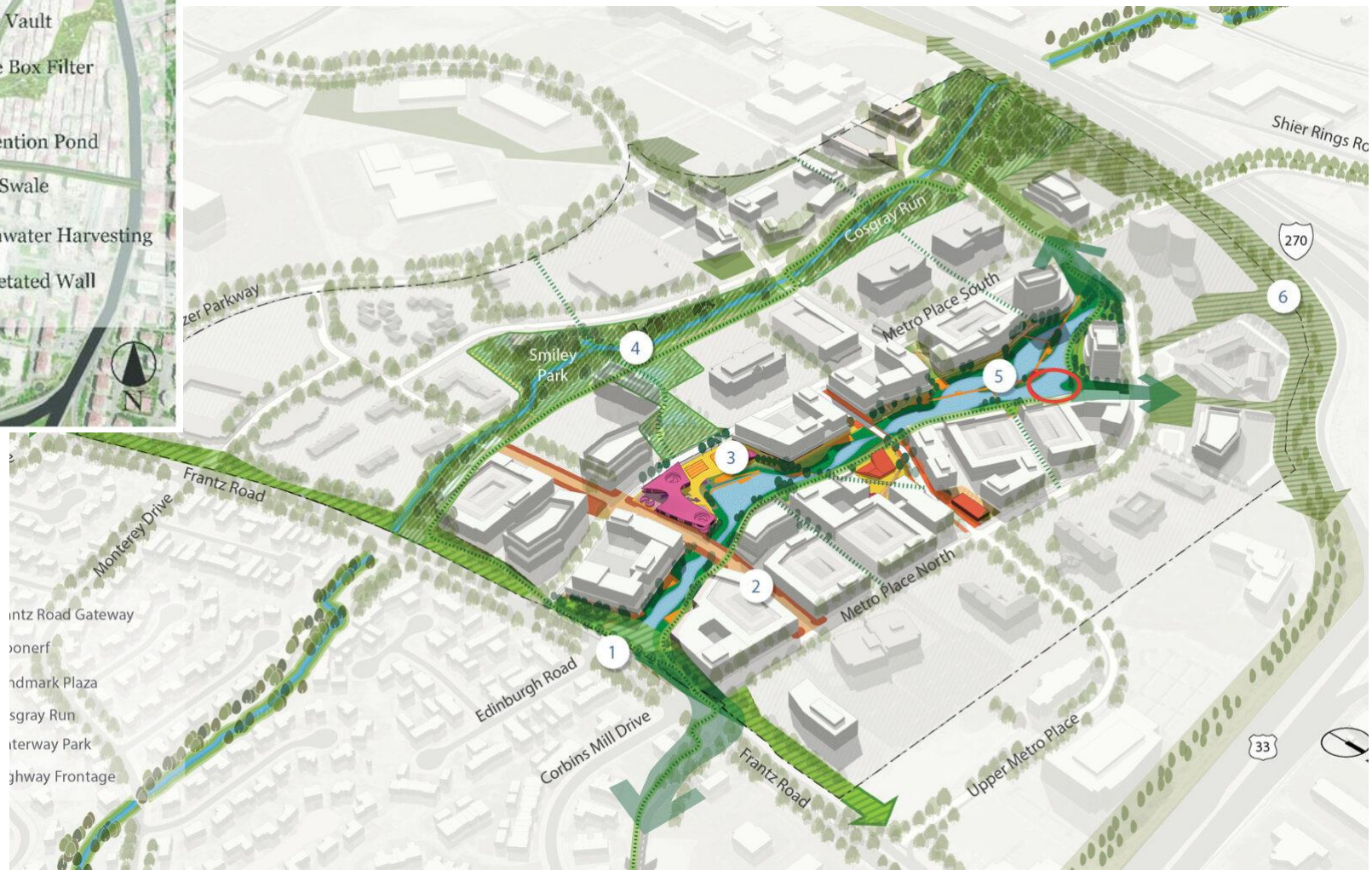


Griffiths, J.; Borne, K.E.; Semadeni-Davies, A.; Tanner, C.C. Selection, Planning, and Modelling of Nature-Based Solutions for Flood Mitigation. Water 2024, 16, 2802. https://doi.org/ 10.3390/w16192802

Master Nature-Based Planning



Above: Salata, S.; Arslan, B. Designing with Ecosystem Modelling: The Sponge District Application in 'Izmir, Turkey. Sustainability 2022, 14, 3420. https:// doi.org/10.3390/su14063420



Right: City of Dublin, OH Metro Area Strategic Plan by Sasaki Associates, Inc.

Considerations for today's presentation…

What are my short and long-term goals?

What types of NBSs may fit the timeframe of these goals?

How may these, or other, NBSs be incorporated in my projects?

What level of risk are we comfortable with?

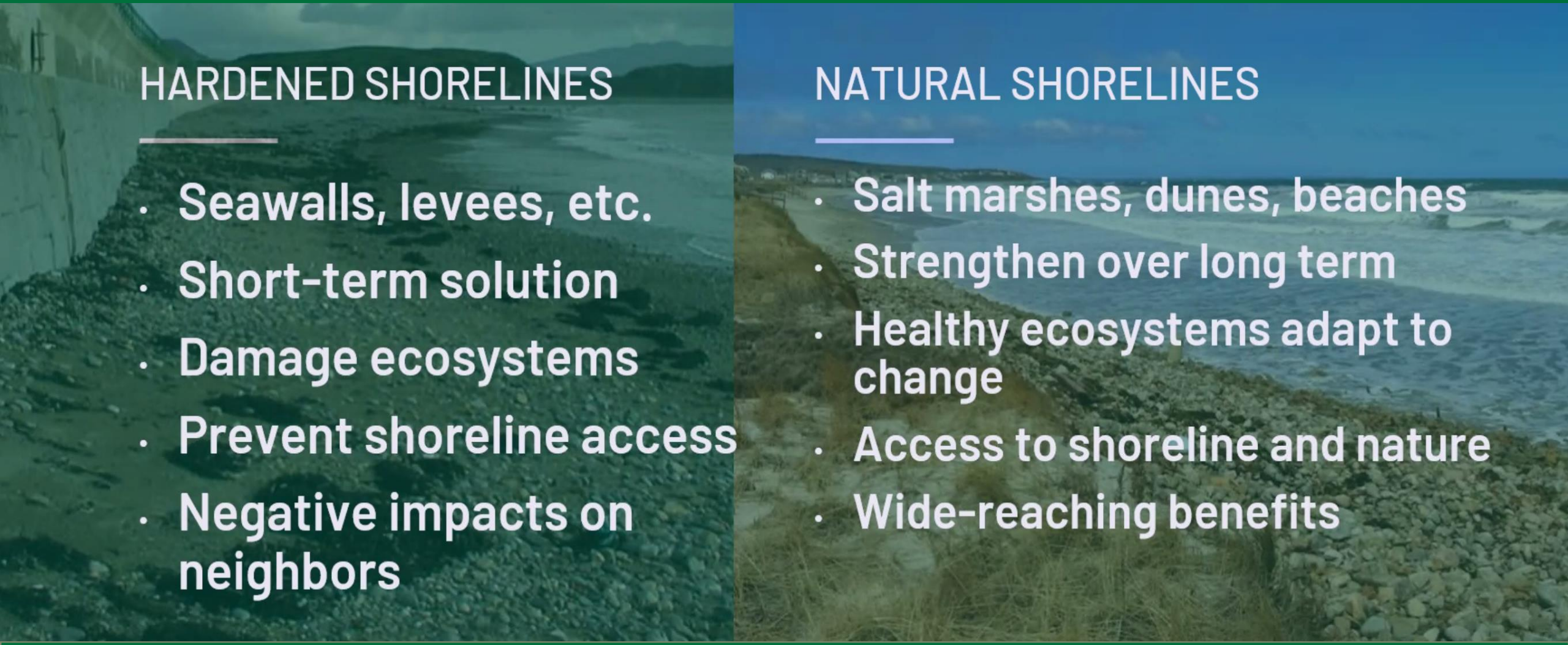
Demystifying Nature-Based Strategies

Helena Tatgenhorst
Coastal Program Manager

The Nature Conservancy
Maine

What are NBS?

Why use NBS?



HARDENED SHORELINES

- Seawalls, levees, etc.
- Short-term solution
- Damage ecosystems
- Prevent shoreline access
- Negative impacts on neighbors

NATURAL SHORELINES

- Salt marshes, dunes, beaches
- Strengthen over long term
- Healthy ecosystems adapt to change
- Access to shoreline and nature
- Wide-reaching benefits

The Nature Conservancy Maine

Types of NBS

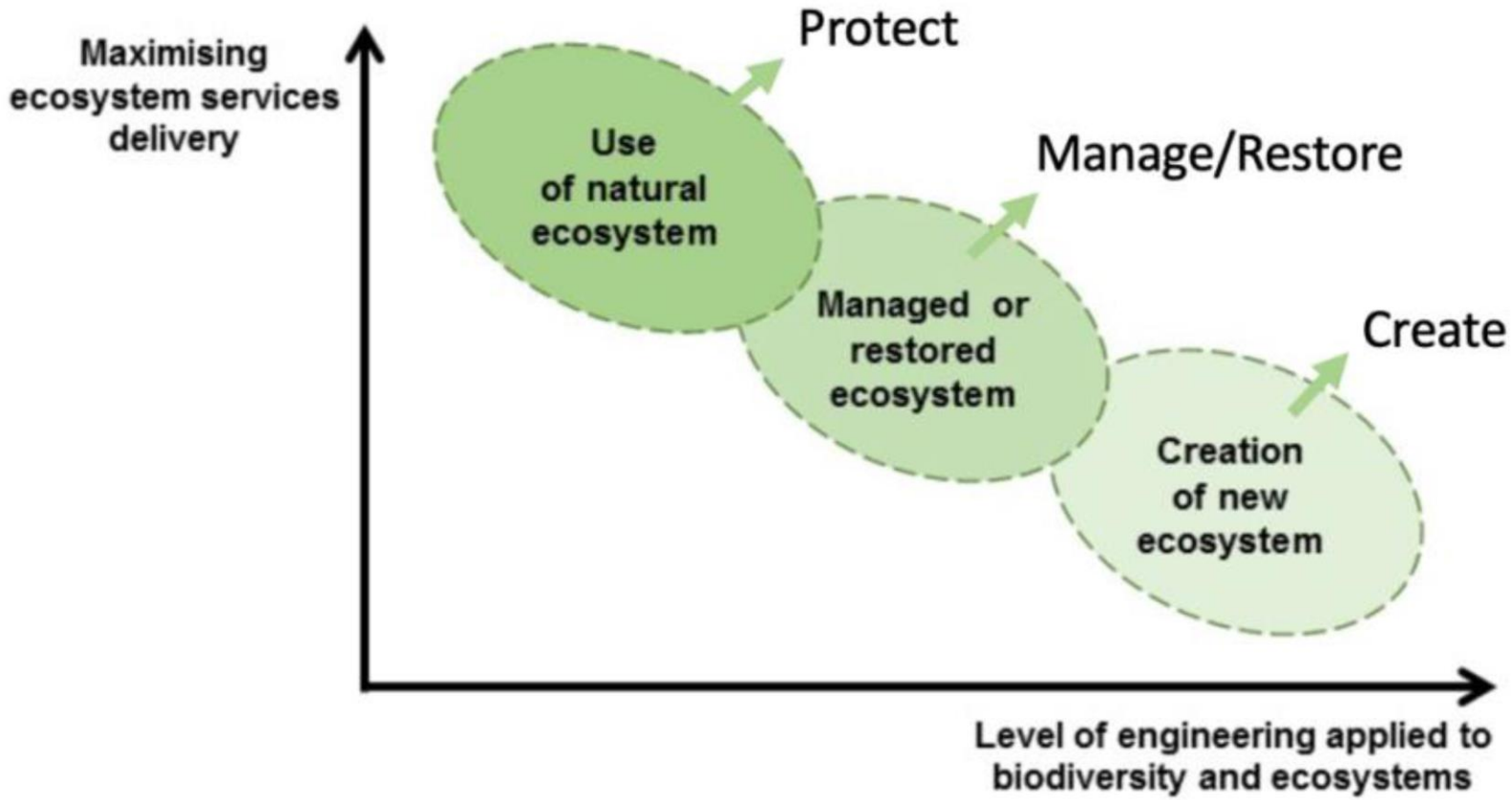
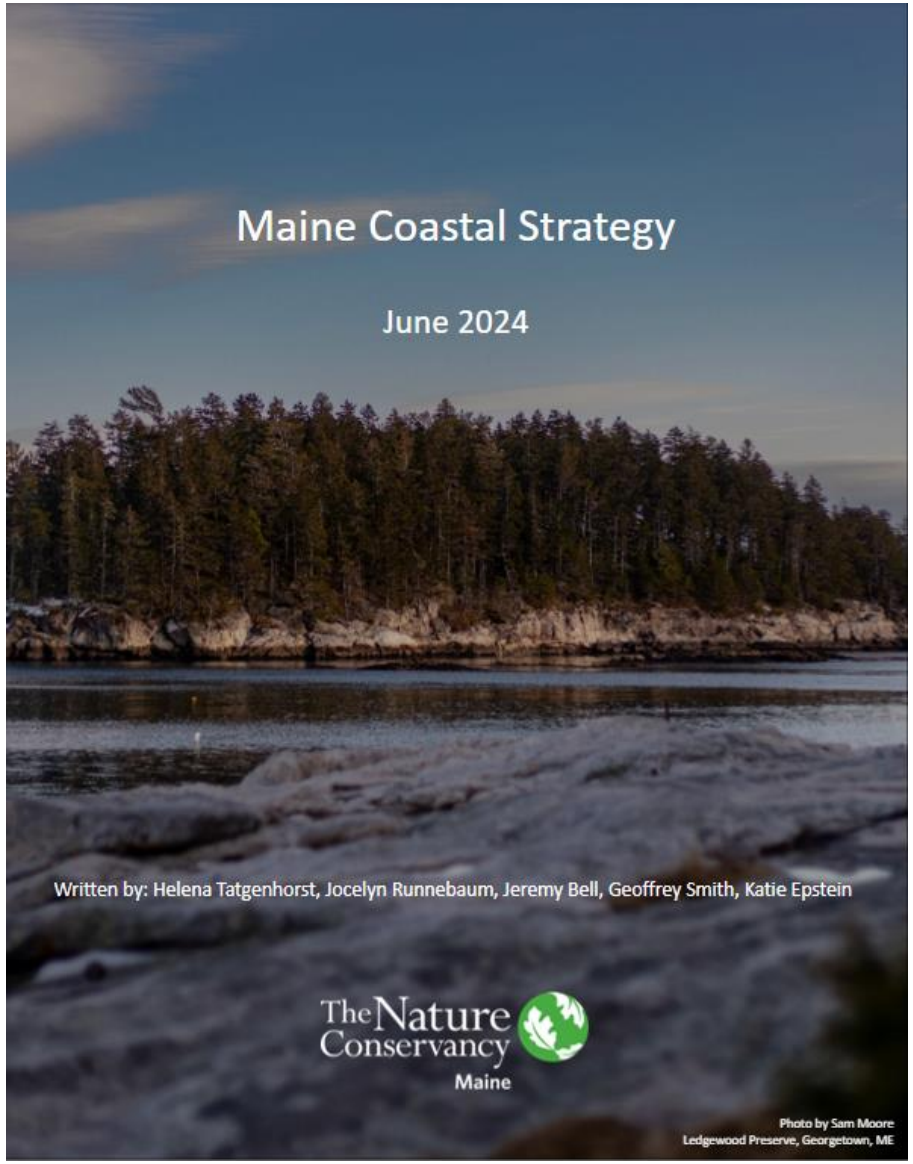


Figure adapted from Eggermont et al., 2015

How does The Nature Conservancy engage in NBS?



Climate resilient tidal marshes

- Develop the **Maine Tidal Marsh Restoration Network**
- Engage with the **Maine Blue Carbon Network**

Photo by Helena Tatgenhorst

Sprague Marsh, Phippsburg, ME

Climate Resilient shellfish beds

- Build a S**hellfish Restoration Community of Practice**
- Develop a permitting system for shellfish restoration
- Develop a Maine shellfish purchase program

Basin Oyster Project, Phippsburg, ME

Climate resilient Eelgrass Beds

- Engage with the **Maine Seagrass Consortium**
- Develop and mobilize funding for additional research
- Increase state capacity for eelgrass bed monitoring
- Explore opportunities for eelgrass restoration as appropriate

Virginia Coast Reserve

Thank you

Helena Tatgenhorst

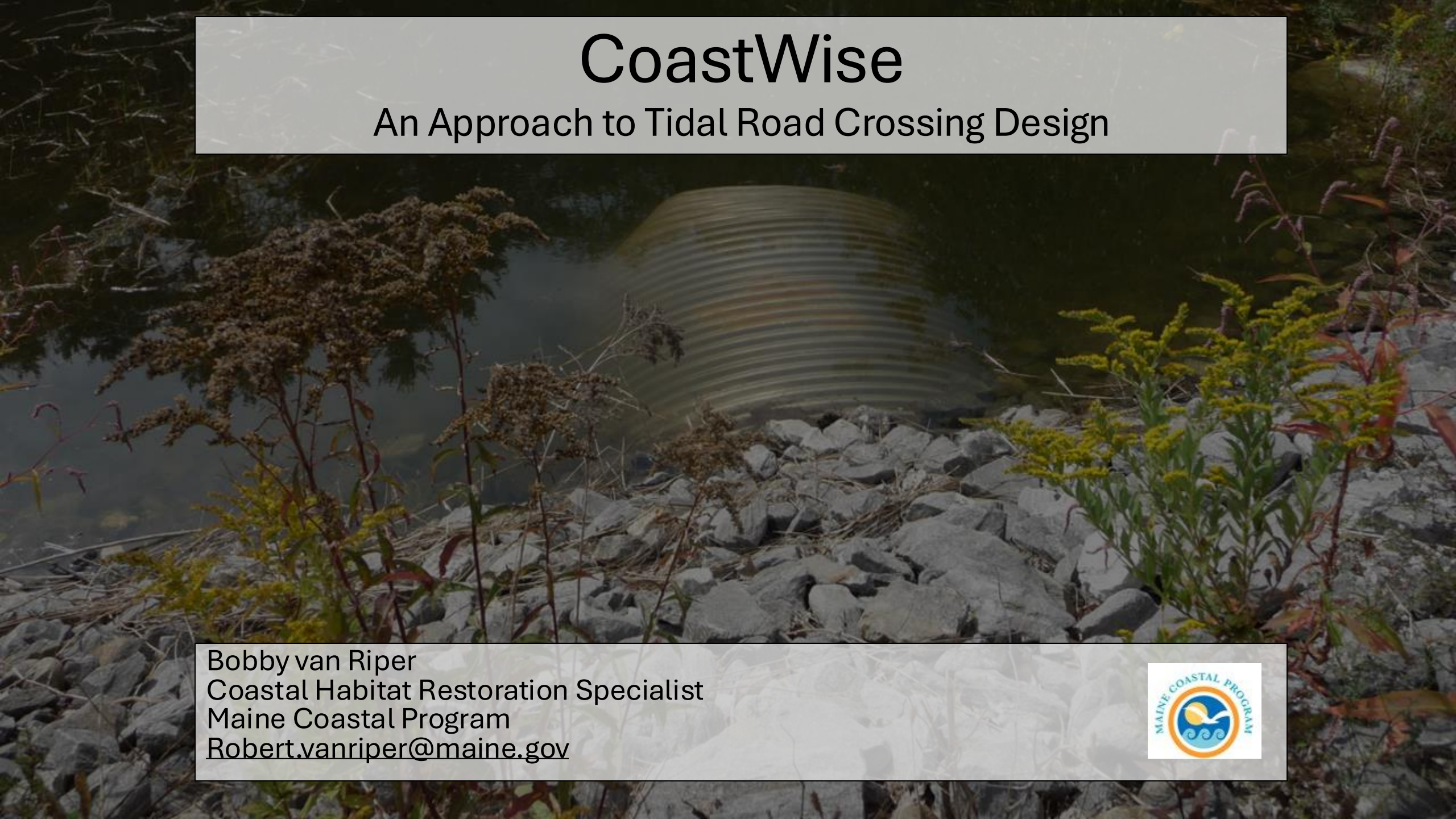
h.tatgenhorst@tnc.org

The Nature Conservancy Maine

Photo by Sam Moore

CoastWise

An Approach to Tidal Road Crossing Design



Bobby van Riper
Coastal Habitat Restoration Specialist
Maine Coastal Program
Robert.vanriper@maine.gov

The CoastWise Approach was developed for **road owners, municipal staff, engineers**, and other people interested in helping to **replace tidal road culverts and bridges** with **safe, climate resilient crossings** – CoastWise is a Team effort!

Link:
https://www.maine.gov/dmr/programs/maine-coastal-program/coastal-community-support/the-coastwise-approach

112 Pages!

Contributors to the Development of CoastWise

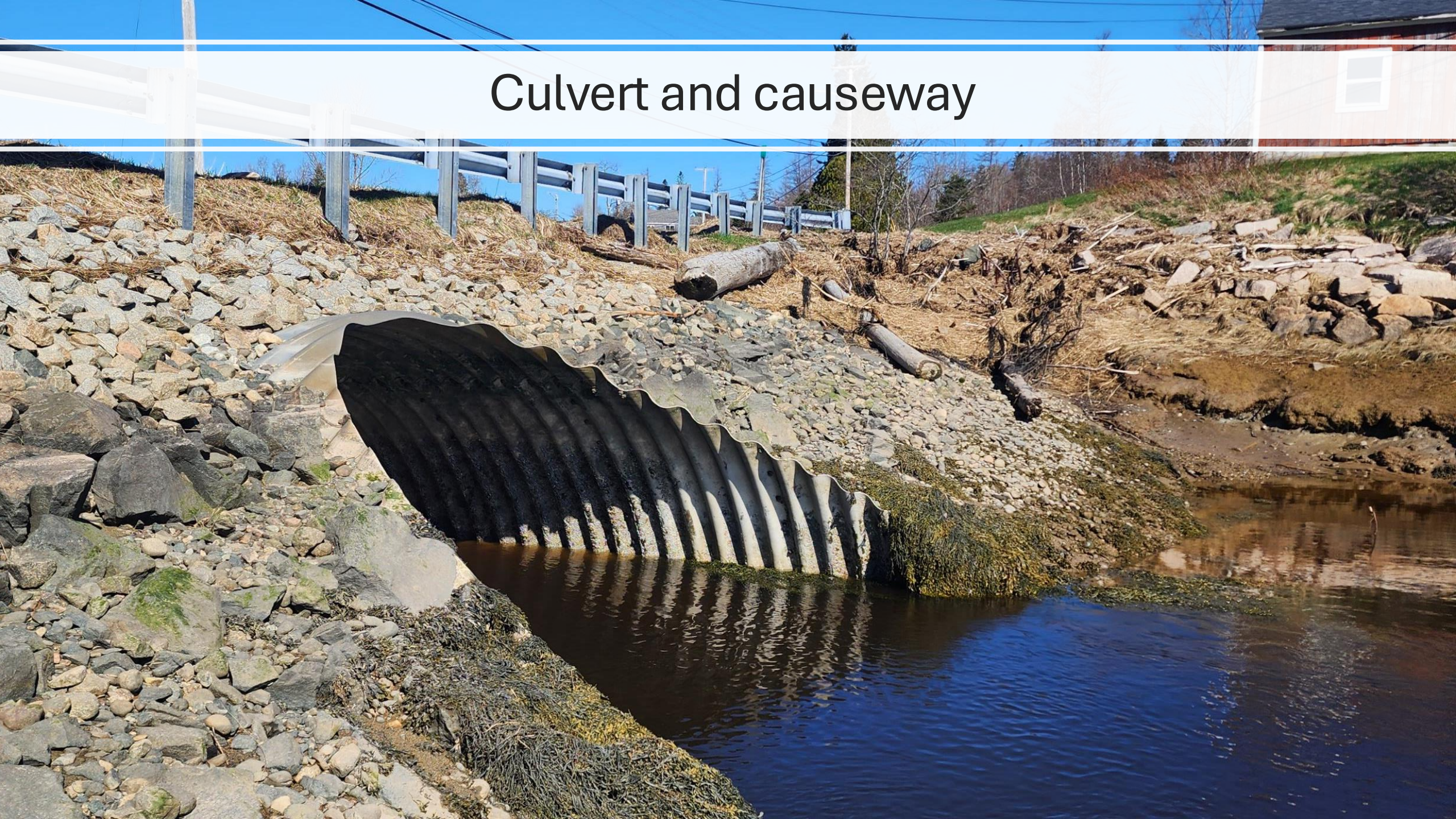
What is CoastWise?

- A guidance document for resilient tidal road crossing replacement.
- A guidance document for salt marsh rehabilitation.
- A source of contacts for questions.
- A primer on Salt Marsh ecology and function.


Tidal restoration projects are a TEAM effort

A Salt Marsh with a ‘causeway’

Culvert and causeway



Why are salt marshes important?

- They capture and retain atmospheric carbon.
- They act as a ‘shock absorber’ for storm surge.
- They capture and process runoff from land.
- They add more ‘biological material’ than any other single habitat.

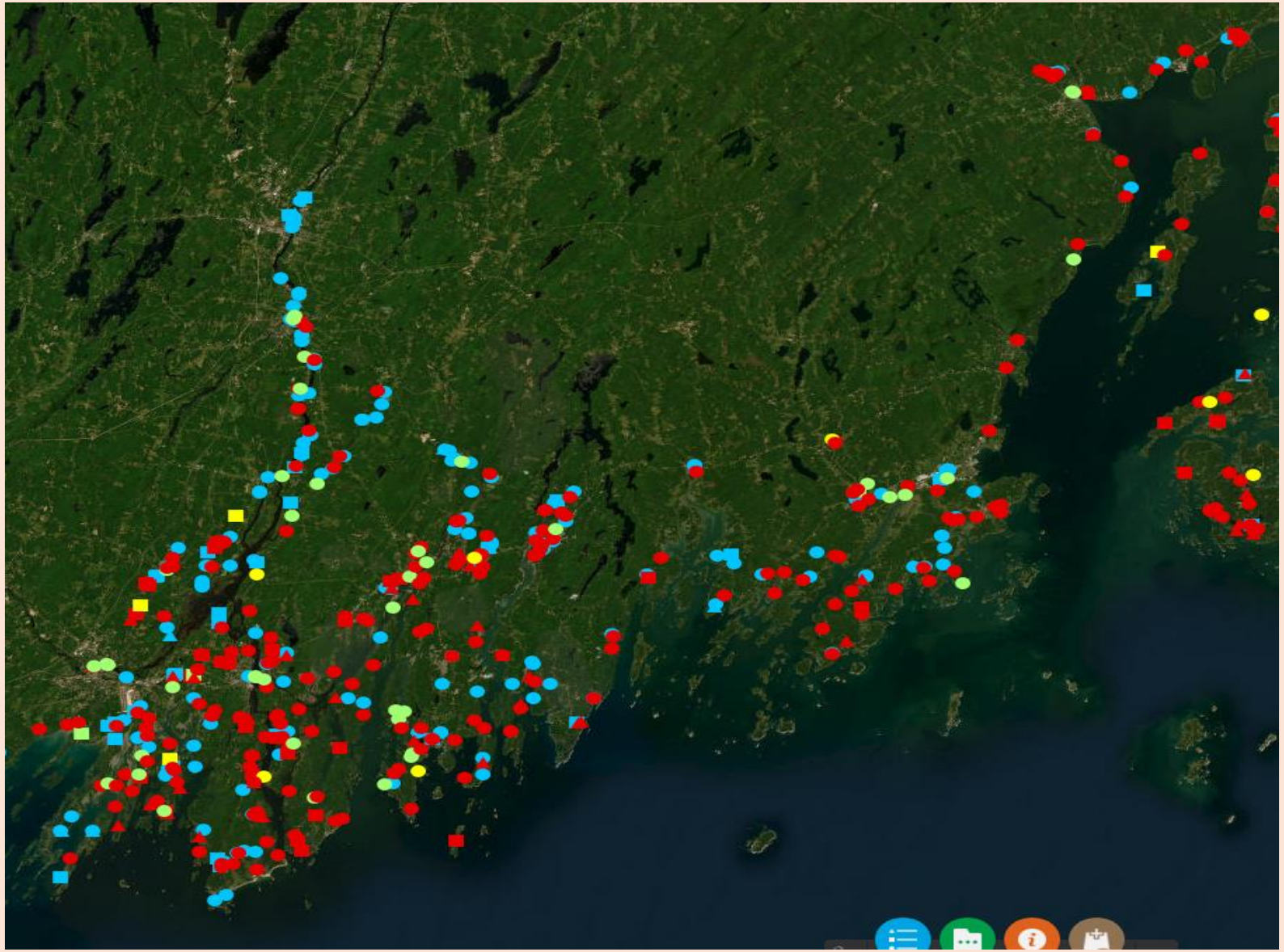
Why are Salt Marshes important?

.....and, they maintain coastal economies!!

Working Waterfront → Supports Local Coastal Economy → Uses Marine Natural Resources → Open Water\Salt Marsh\Mud Flat habitat

*NOAA: 70% of all commercially marketed marine species spend some portion of their life cycles in intertidal habitats.

Maine Tidal Restriction Atlas: Crossing restrictions in the MidCoast



900 tidal road crossings statewide – 800 are undersized. This number will grow over time.

How can YOU undertake a Coastwise project?

- **Connect with a Technical Advisor**
- **Ask for Advice!!!** – Any time. It's a TEAM effort.
- **Start Early** – A project will take 2-4 years to completion.
- **Encourage Local Participation** – Make it a town project.
  - Get to know your town's crossings (desktop, field survey)
  - Establish clear objectives
  - Include Sea Level Rise
  - Include low-lying features of concern
- **Decide What Level of Risk is Appropriate -** How much inundation will be acceptable?

How can YOU undertake a Coastwise project?

- **Collect Preliminary Data**
- **Engage a Qualified Engineer –** For modeling, design services, and contracting documents.
- **Permitting and Coordination –** Discuss permitting needs, timelines, and expectations early on with state and federal regulators.
- **Serve as an Information Source –** Answer questions and concerns of residents.
- **Stay Involved in the Process –** Meet regularly with the Technical advisor and engineer.

How can YOU undertake a Coastwise project?

Contact a Technical Advisor to get started:

Statewide:

Robert Van Riper

Coastal Habitat Restoration Specialist

Maine Coastal Program

Maine Department of Marine Resources

Robert.vanriper@maine.gov

207-592-5689

Bill Bennett

Fish and Wildlife Biologist

Gulf of Maine Coastal Program

US Fish and Wildlife Service

William_Bennett@fws.gov

207-781-8364 X15

Casco Bay:

Matt Craig

Habitat Program Manager

Casco Bay Estuary Project

Matthew.craig@maine.edu

207-228-8359


Questions ??

Some Desktop Resources

- Tidal Restriction Atlas - DMR ME Coastal Program Website
- Coastal Risk Explorer – TNC Website
- Maine Stream Habitat Viewer – MDIFW Website
- Maine DOT Public Map Viewer – MDOT Website
- Beginning With Habitat – MDIFW Website
- Google Earth
- Maine Geolibrary - MEGIS Website
- USGS Historical Topo Explorer – USGS Website
- Historic Aerial Photo Library – ME Geological Survey – DACF Website
- NOAA – All at NOAA Websites
  - Section 7 Mapper (Threatened and /Endangered Species)
  - Essential Fish Habitat Mapper
  - Digital Earth

OUR SHORE

Nature-based Shoreline Stabilization Practices

Nathan Robbins
Climate Change Program

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

Protecting Maine's Air, Land, and Water

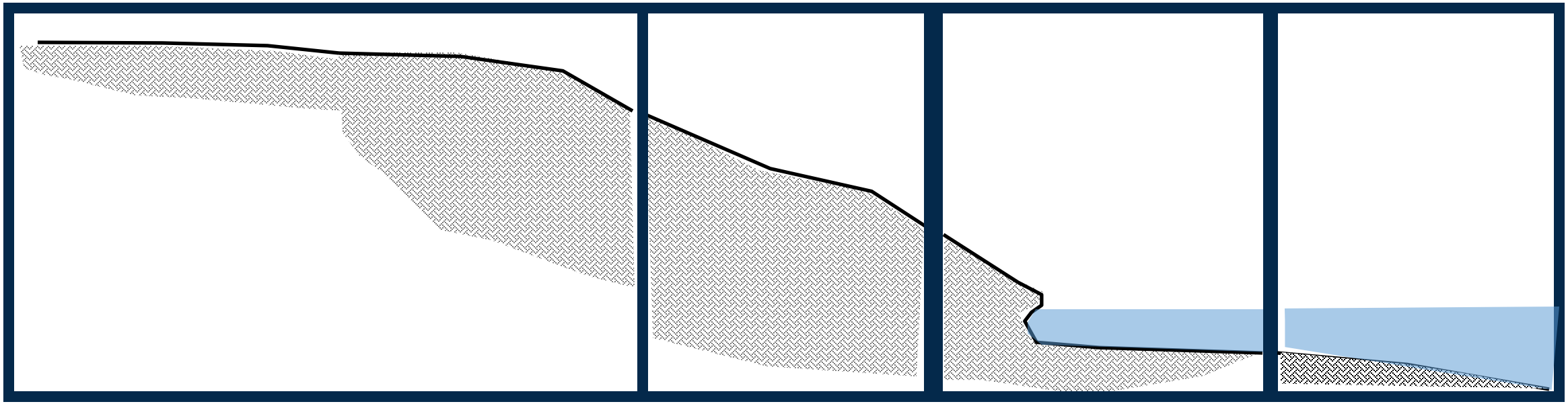
A Combination of Factors

Land Use & Overland Water

Height/Slope of Bank & Soil Protection

Toe Stability & Groundwater

Wave energy

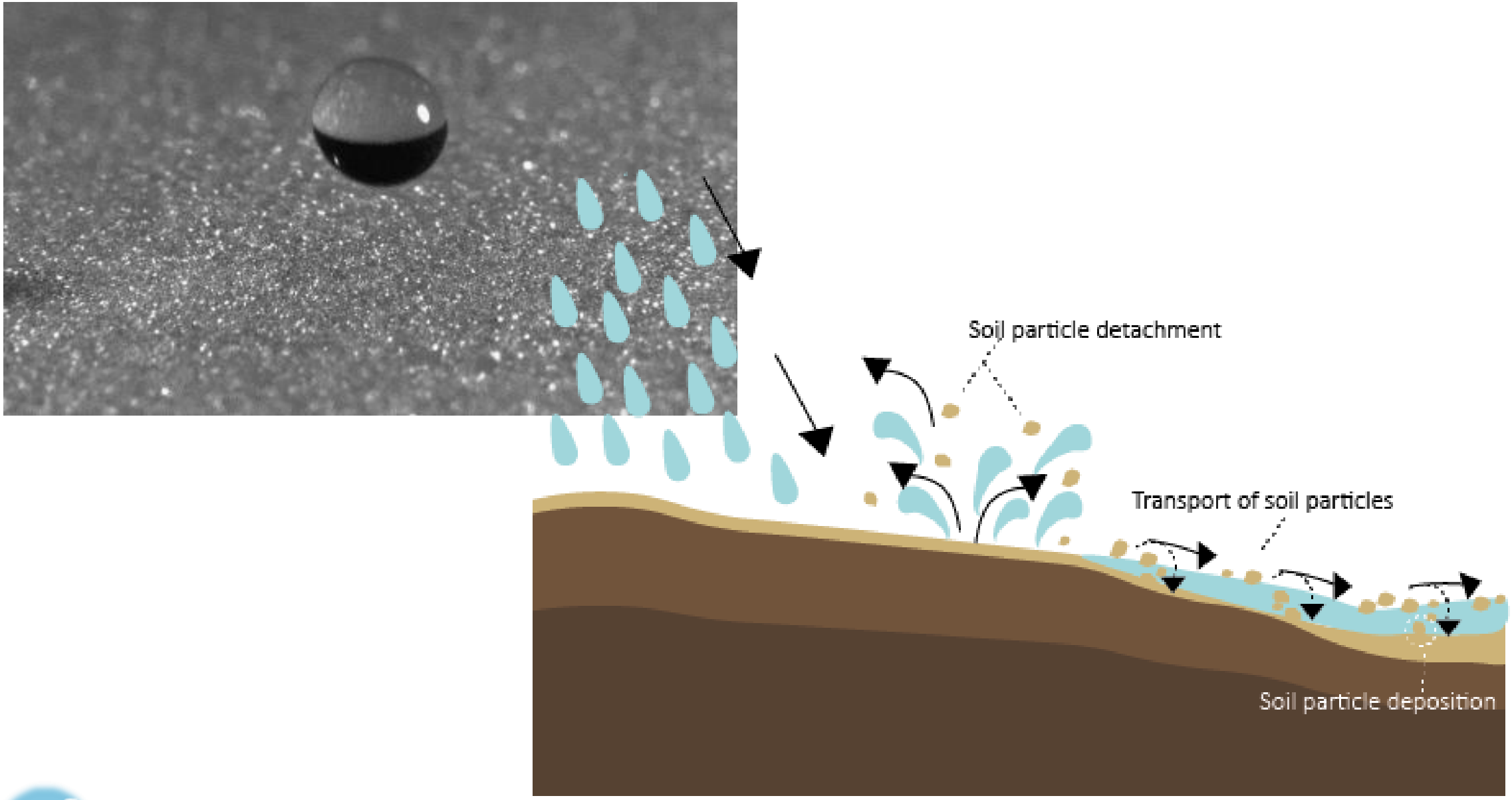


What's on the land?

How tall and steep is the slope?

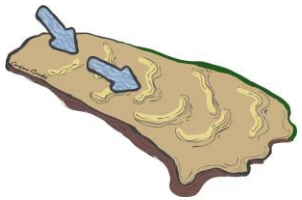
What's happening at the bottom?

How big are the waves and currents?

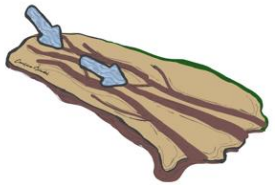

Soil particle detachment
Transport of soil particles
Soil particle deposition

Splash

(Raindrop)



Sheet



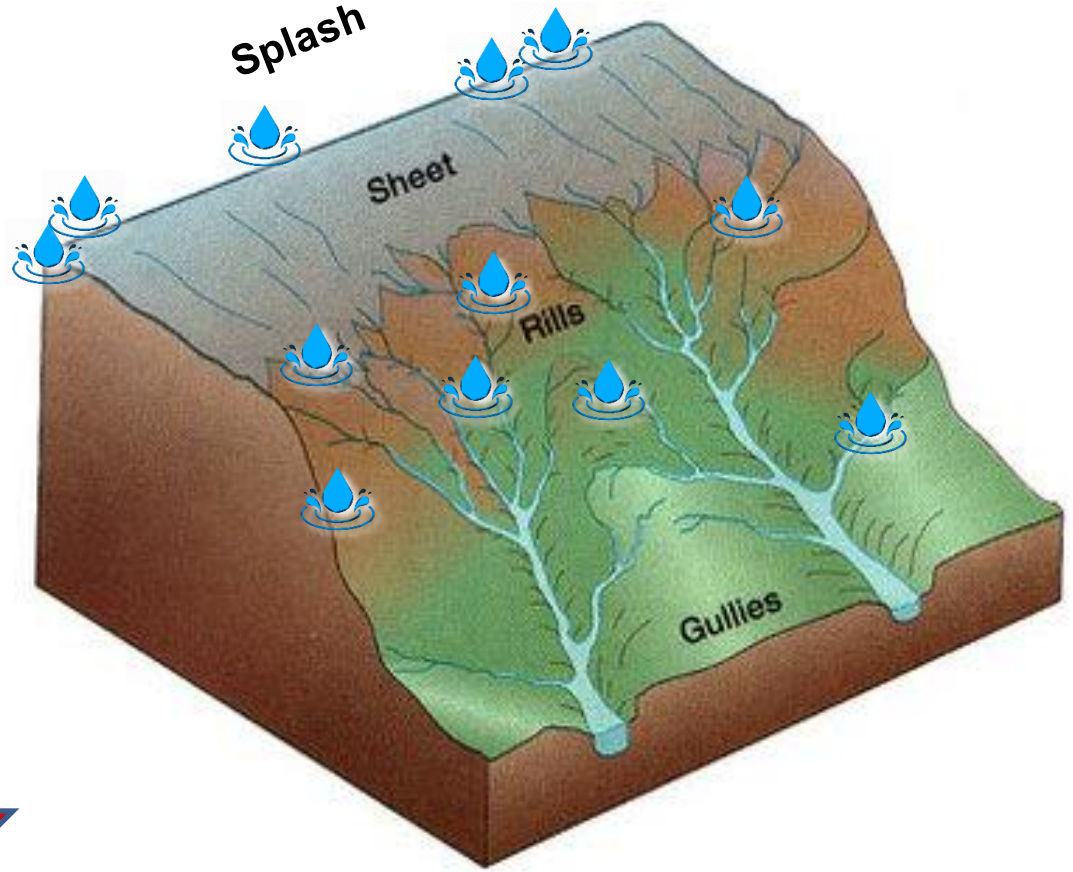
Rill

(Shallow concentrated)

Gully

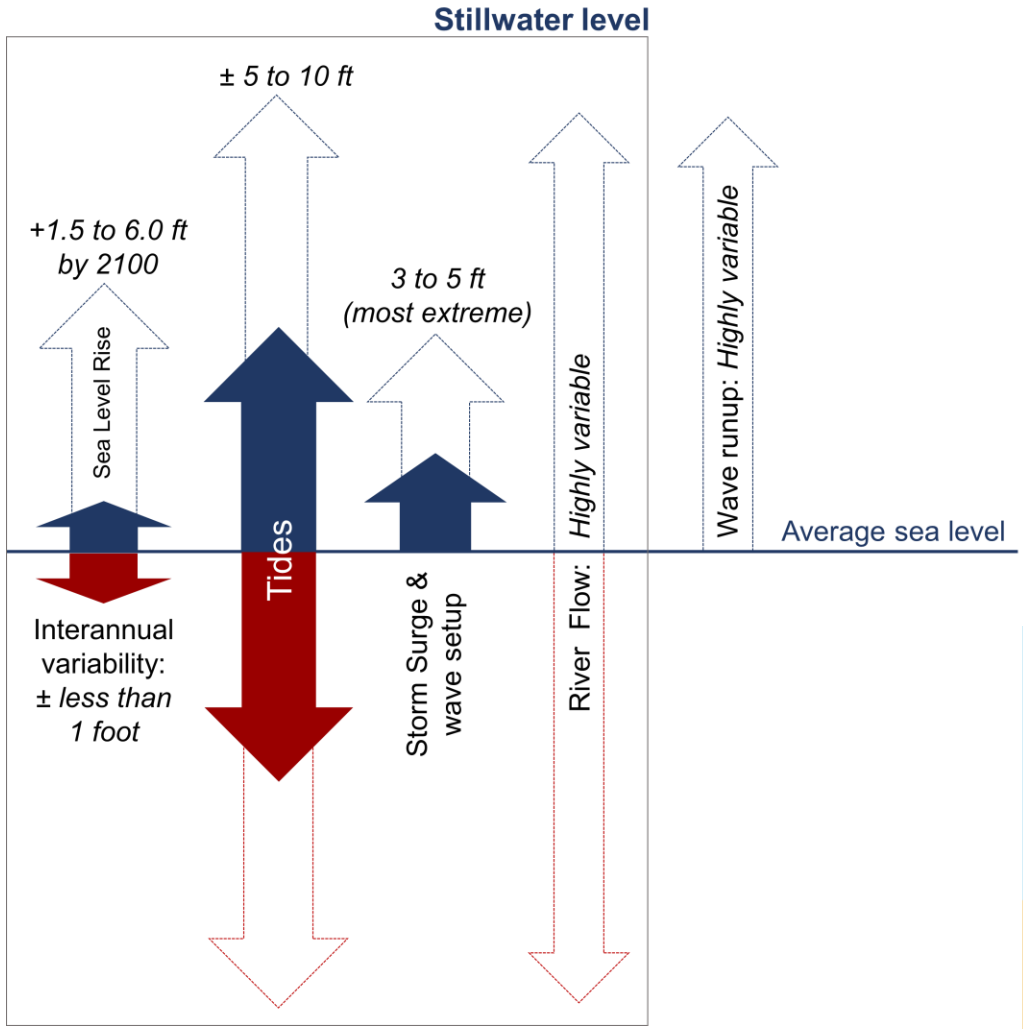
(Concentrated)

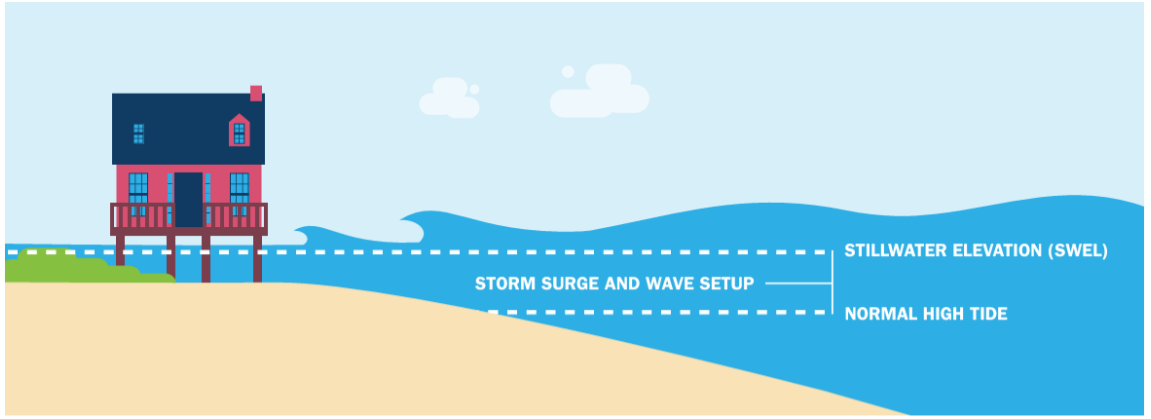
Increasing Power



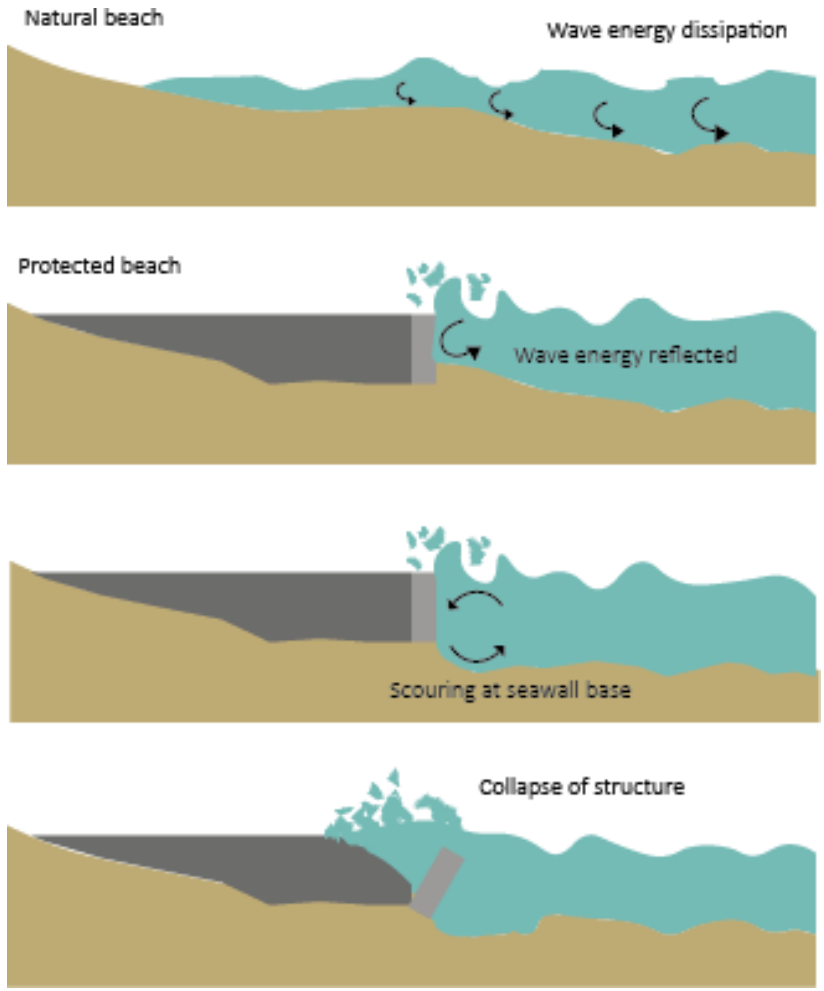
High Water

Waves

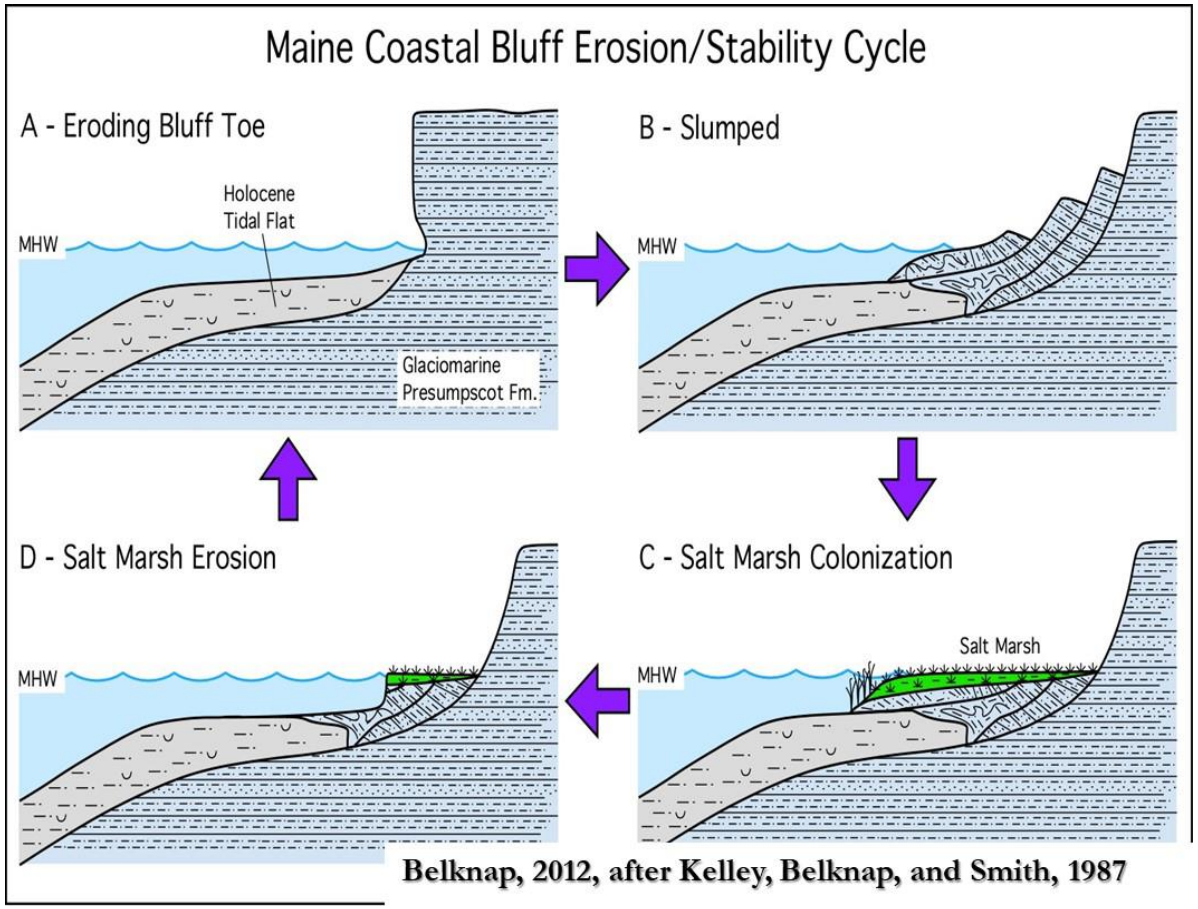




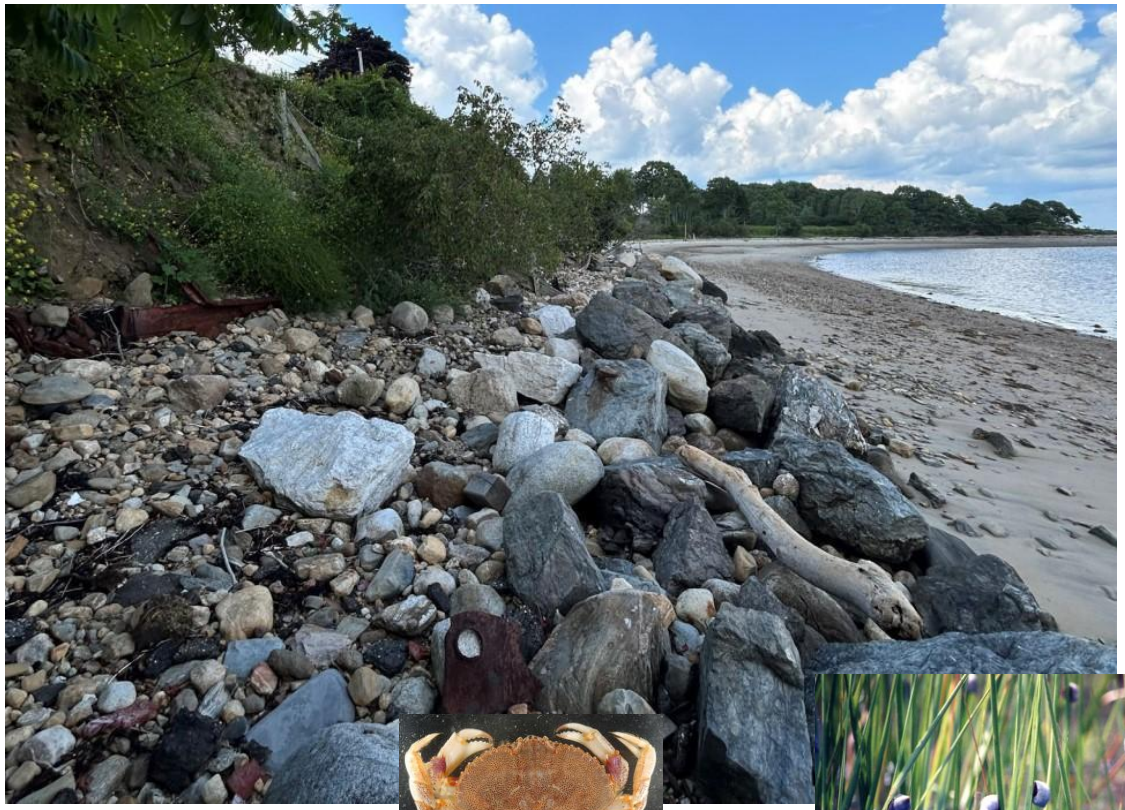
Illustrations from *FEMA Coastal Hazards and Flooding: A Visual Guide* showing stillwater elevation (upper panel) and wave runup and overtopping (lower panel).


Natural beach
Wave energy dissipation
Protected beach
Wave energy reflected
Scouring at seawall base
Collapse of structure

What if the soils are sandy?

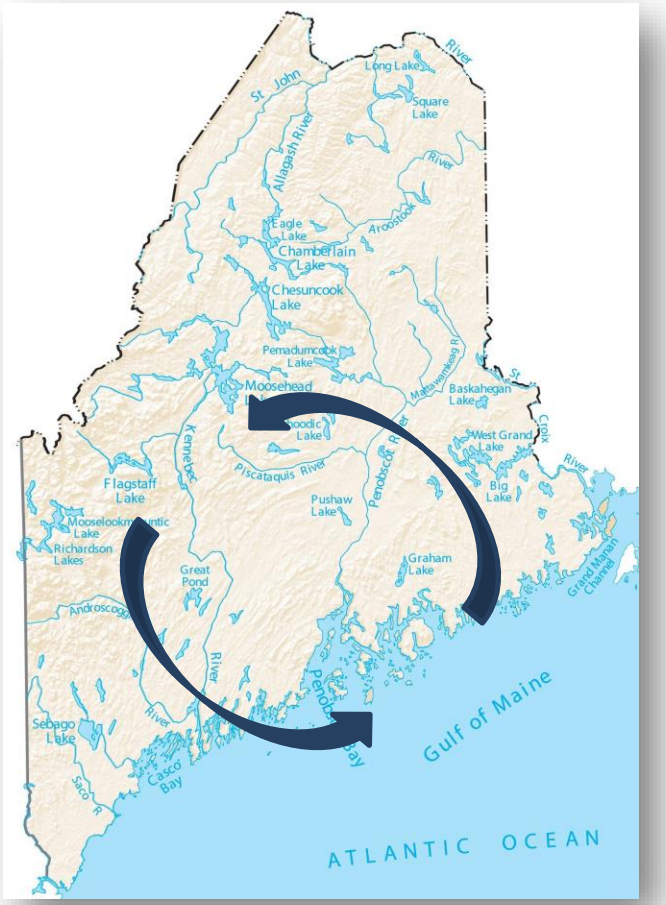


Belknap, 2012, after Kelley, Belknap, and Smith, 1987




Nearmap

“OUR SHORE” CONCEPT



Assessment & Selection of Stabilization Tools that:

1. Use the least amount of intervention and disturbance necessary

2. Allow shorelines to function as natural systems as quickly as possible

This is key to protecting the shoreline stability, water quality, and habitat for fish and wildlife in the long term

O U R S H O R E

Design goals and objectives

Observe and blend project with unaltered shorelines near the site,

Use native, natural, living, and biodegradable materials, and

Reach conditions that function as a naturalized shoreline over time.

Assessment of instability

Source and severity of erosion,

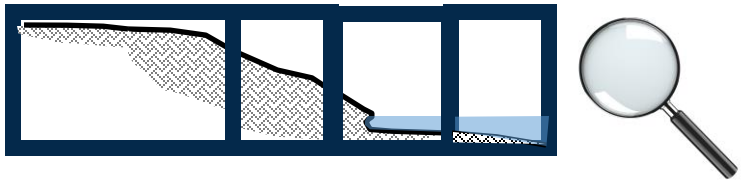
Height and slope risk,

Overland water and land use, and

Re-vegetation or reconnection shoreline buffer opportunities.

Based on findings

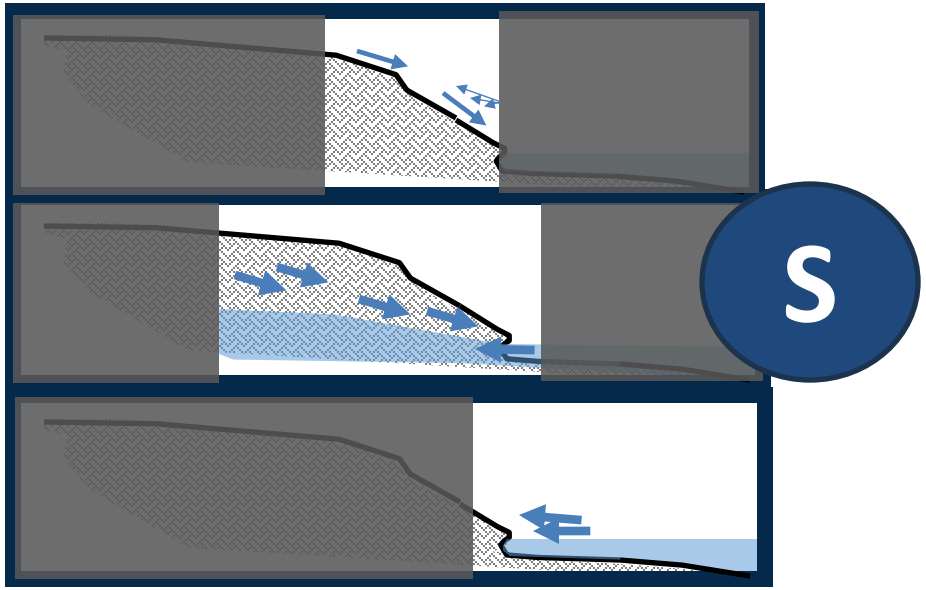
Erosion control practices can be selected based on site specific needs.



Overland Erosion & Wave Spray

Groundwater & Saturation

Toe Erosion

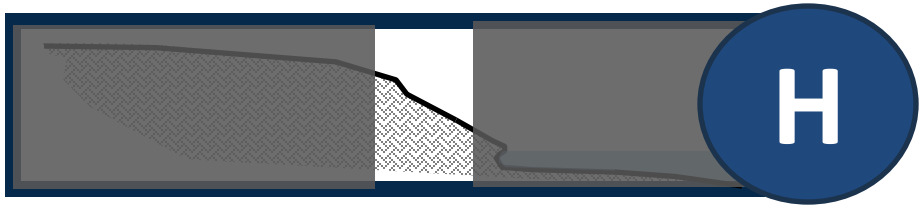


S

Source of Erosion

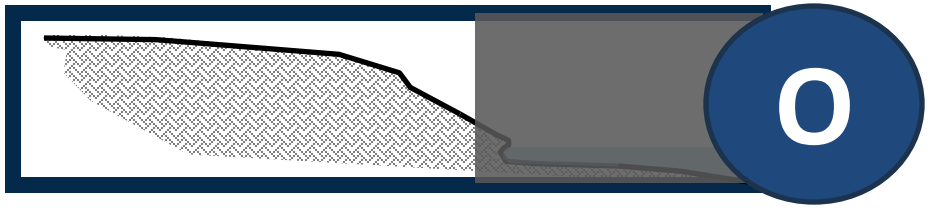
Slope Alterations

Slope Protection



H

Height & Slope



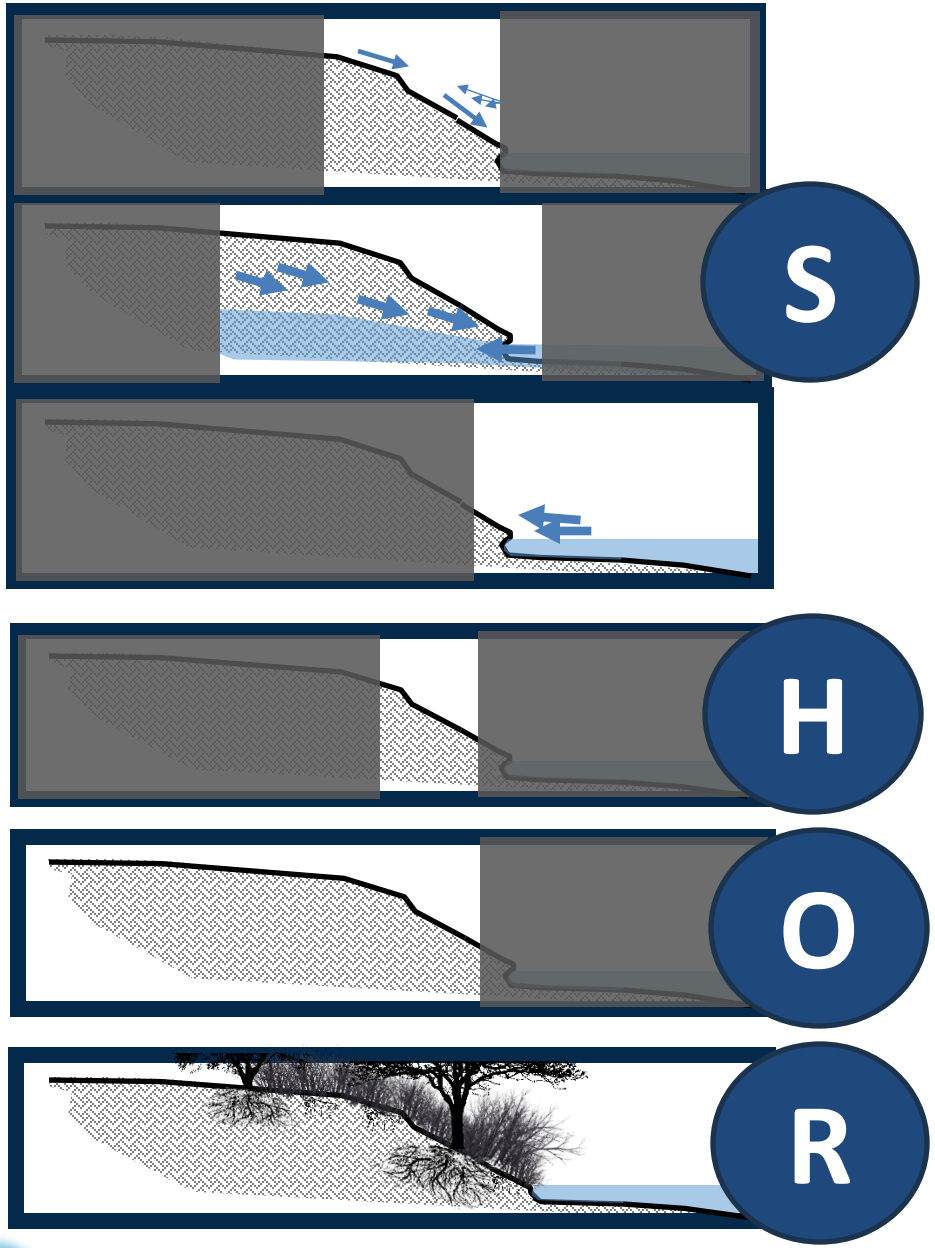
O

Overland Water from Land Use

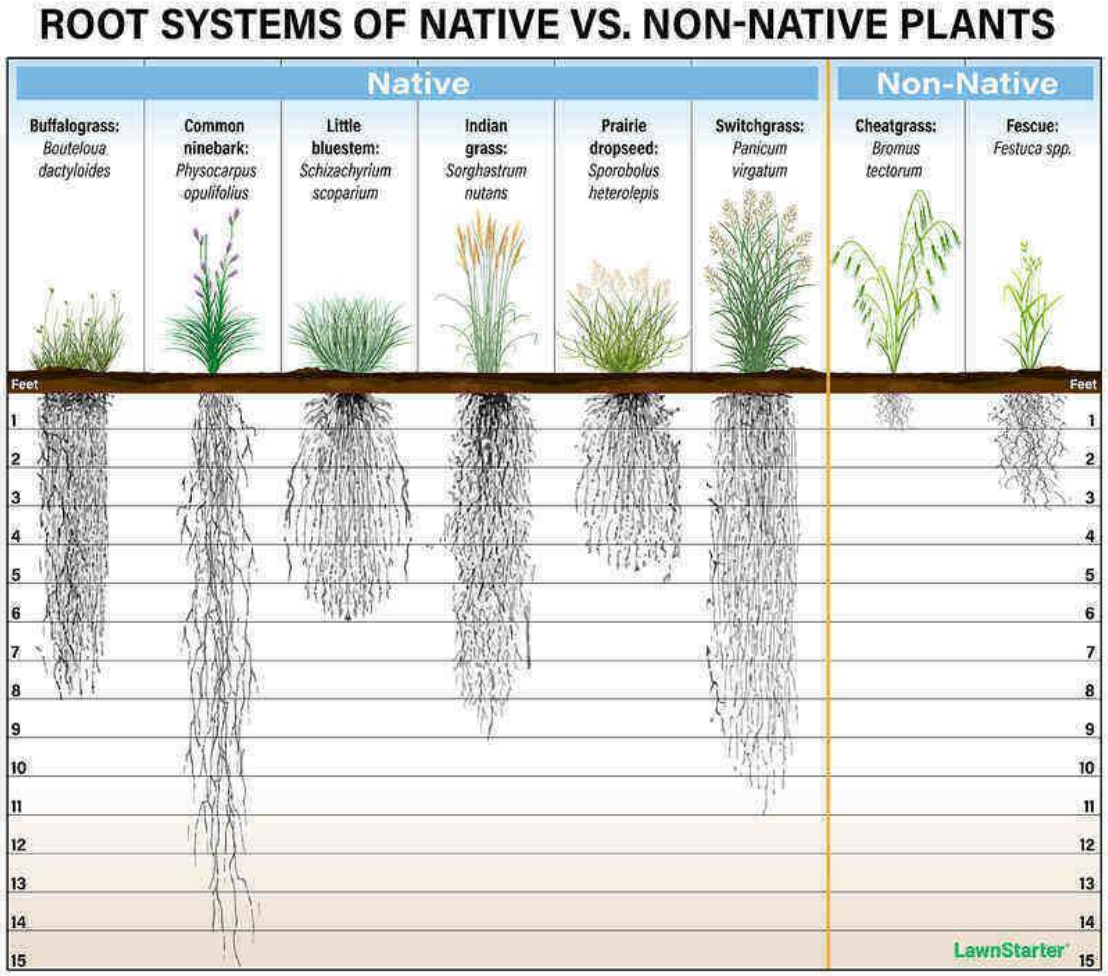
R

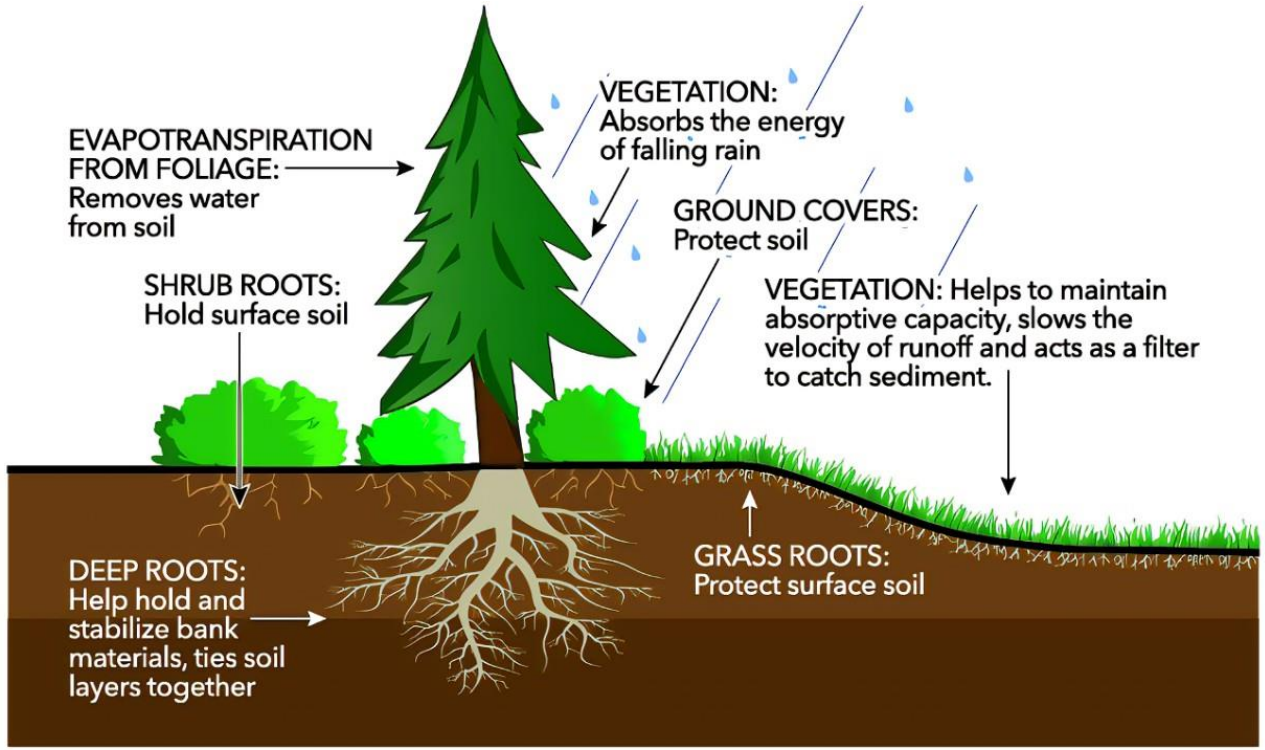
Revegetate & Re-connect (Habitat)

Slow the Flow. Spread it Out.



Stabilize Soils





EFFECTS OF VEGETATION IN MINIMIZING EROSION

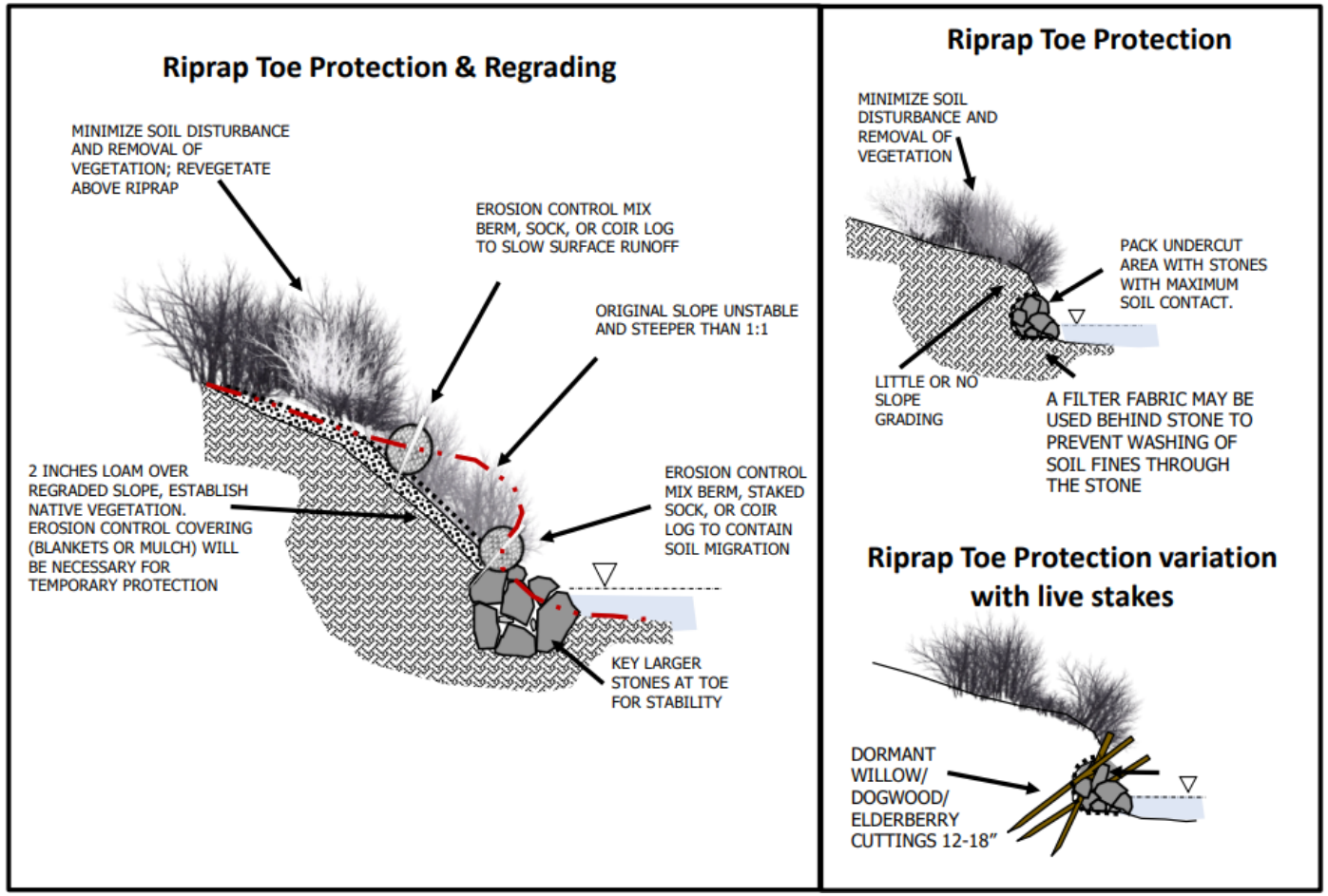
Minimize…

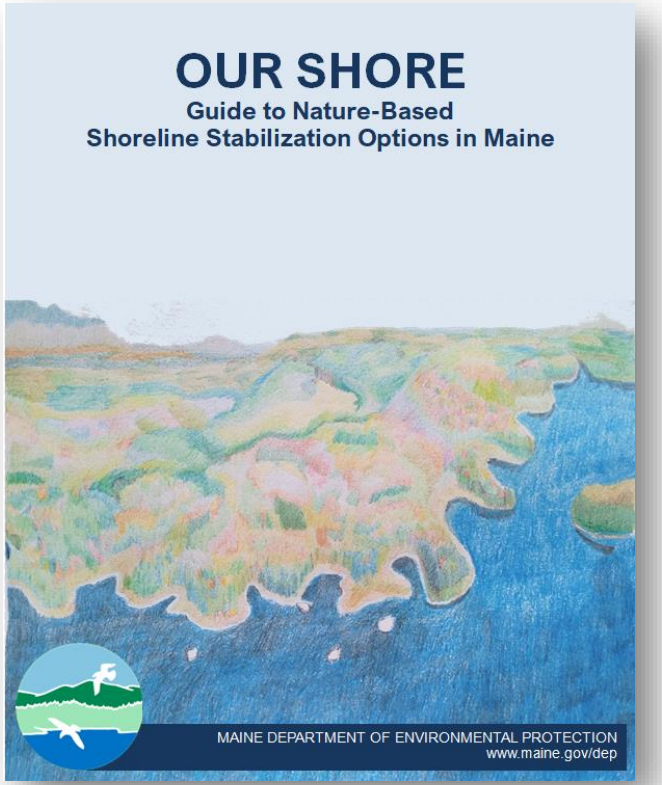
Destruction of habitat (species connectivity)

Energy deflection (nearshore and adjacent erosion)

Jumpstart protection with plants

Combining Practices





Assess sources of erosion → Identify appropriate design practices → Navigate permit processes

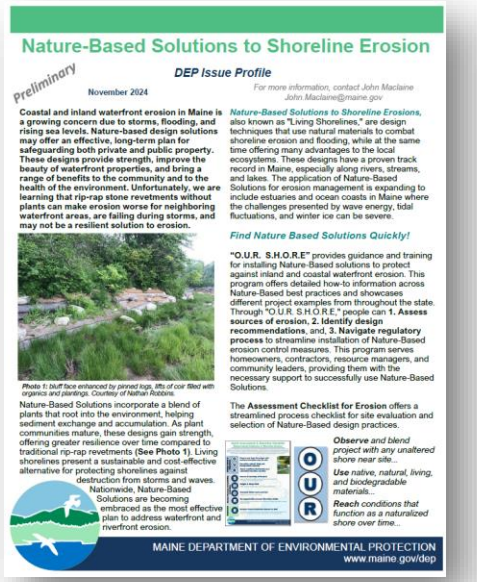
OUR SHORE: Guide to Shoreline Stabilization Options

Comprehensive guide to the OUR SHORE approach

- **Basic Guidance on Shoreline Function**
  Shoreline erosion process, role of vegetation, OUR SHORE concept
- **Assessment of Erosion Sources**
  Sources of instability and severity of risk
  & Assessment Checklist of Erosion and Erosion Control Practices
- **Tools and Practices**
  Descriptions and pictures of common design practices covered in the guide

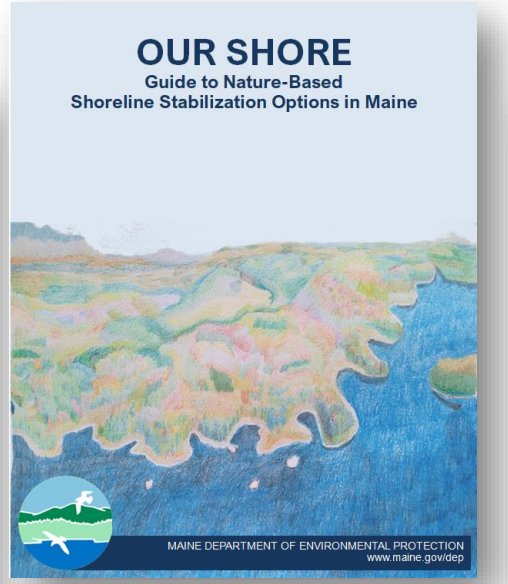
- **Common Materials in Nature-based Shoreline Stabilization**
  Short list of common materials
- **Planting Guide**
  Summarizes go-to planting guides for Maine landscapes
  (includes short list of inland and coastal shoreline plants)
- **Outcomes & Case Studies**
  Example design solutions for different landscapes and case studies
  (Lakes, Rivers, Streams, Beaches and Dunes, Bluffs)

IN DEVELOPMENT

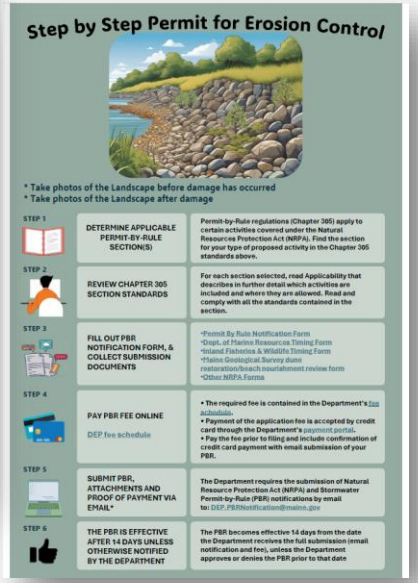


PROGRAM ISSUE PROFILE

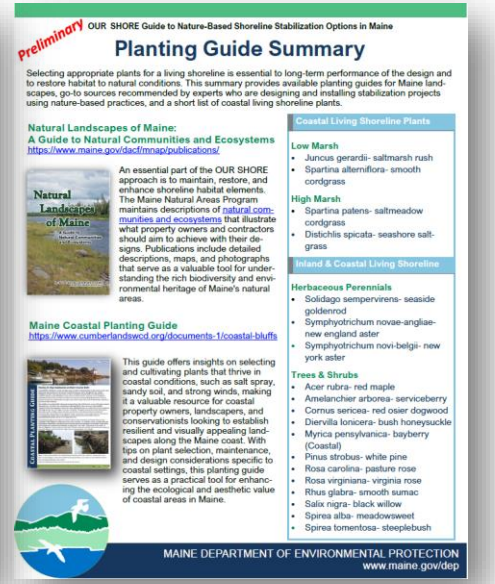
ON SITE CHECKLIST



OUR SHORE GUIDE



PERMITTING SUPPORT



PLANT SELECTION

Chapter 305 §16-A Beach Nourishment and Dune Restoration or Construction in Coastal Sand Dunes (Emergency)

- Allowed for biodegradable materials in dune restoration projects (expired in early May 2024)

Chapter 305 Permit-By-Rule & Chapter 310 Wetlands and Waterbodies

- DEP proposed rule changes to the BEP (November 2024)
- Proposal includes §16-A changes
- Creates a definition for “shoreline stabilization”
- Adds section to establish standards for purpose of shoreline stabilization projects
- Encourages permitting for use of vegetation and biodegradable materials
- Places some limits on the use of hardened stabilization structures

THANK YOU

These initiatives would not be possible without the contributions of *many* agency, contractor, municipal, and other resilience practitioners

RESOURCES

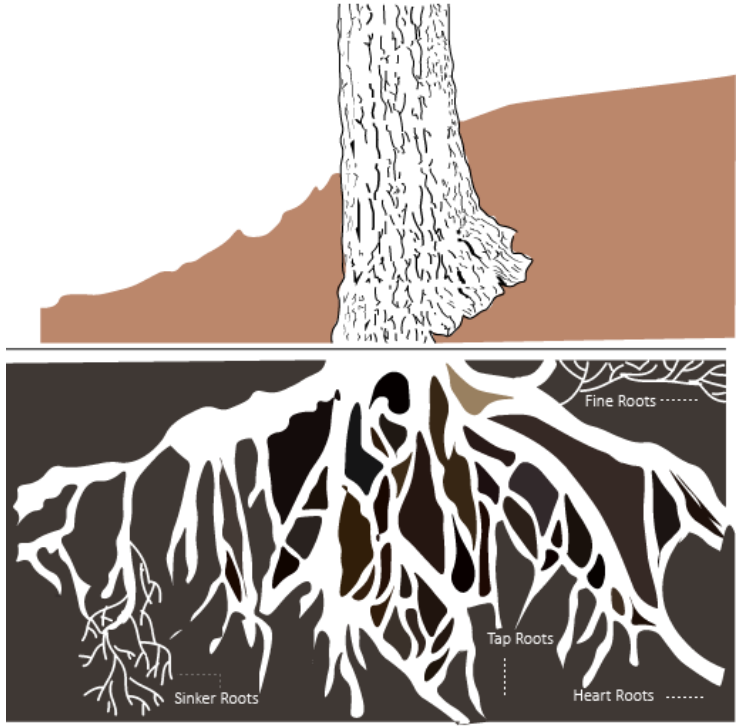
Nonpoint Source Training Center
https://www.maine.gov/dep/land/training/index.html

Department Rulemaking Proposals
https://www.maine.gov/dep/rules/index.html

Maine Conservation Corps
https://www.maine.gov/DACF/parks/get_involved/conservation_corps/index.shtml

Maine Climate Hub
maine.gov/dep/sustainability/climate/index.html

Maine Climate Science Information Exchange
https://umaine.edu/mcsie/



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Demystifying Nature-Based Strategies
Case Studies from Maine's coastal environments

Natural Hazards and Land Use Planning 101 Webinar Series

Hybrid dune restoration, Laudholm Beach, V. Beaulieu, Wells Reserve

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What's a "Living Shoreline"?

Living shoreline is a broad term that encompasses a range of shoreline stabilization techniques along estuarine coasts, bays, sheltered coastlines, and tributaries. A living shoreline:

- has a footprint that is made up **mostly of native material**.
- **incorporates vegetation** or other living, natural "soft" elements **alone or in combination with** some type of harder shoreline structure (e.g. oyster reefs or rock sills) for added stability.
- **maintains continuity of the natural land–water interface** and reduce **erosion** while providing **habitat value** and enhancing **coastal resilience**.

Image by Maine DEP; definition adapted from NOAA's Guidance for Considering the Use of Living Shoreline

About 50% of our coastline is comprised of rocky cliffs where living shorelines don't make too much sense

Portland Head Light, Cape Elizabeth, P. Slovinsky, MGS

Yet living shorelines can be implemented along <u>much</u> of Maine's coast

Sandy dune, Western Beach, Scarborough

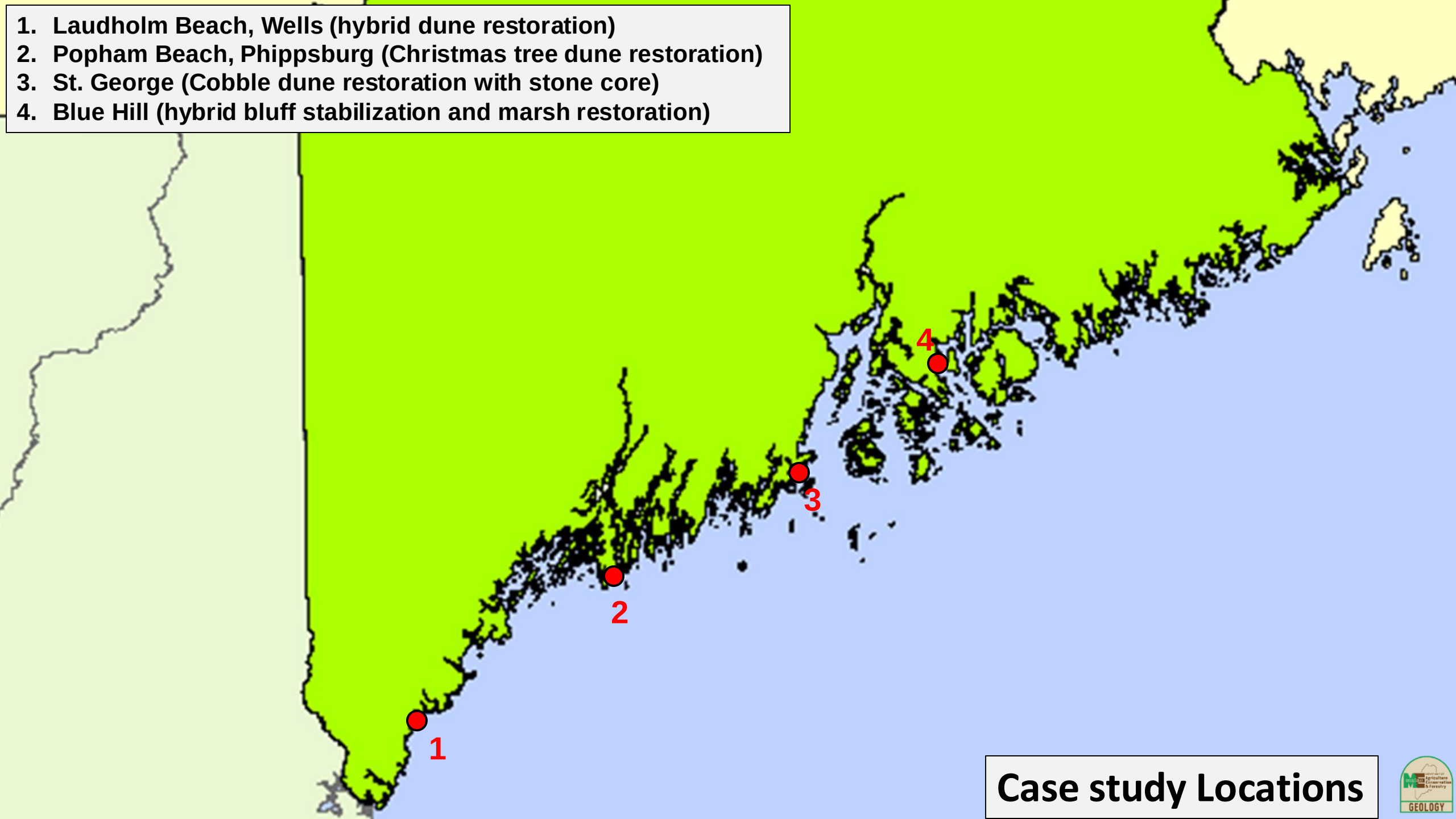
Coastal Sand Dune Systems (sandy dunes, gravel and cobble dunes)

Coastal Bluffs and adjacent habitats (sand dunes, mud flats, sand flats, wetlands)

Coastal Wetlands (low marsh, high marsh)

Coastal wetland, Wells

Bluff with adjacent mud flat, Brunswick


1. Laudholm Beach, Wells (hybrid dune restoration)
2. Popham Beach, Phippsburg (Christmas tree dune restoration)
3. St. George (Cobble dune restoration with stone core)
4. Blue Hill (hybrid bluff stabilization and marsh restoration)
1
2
3
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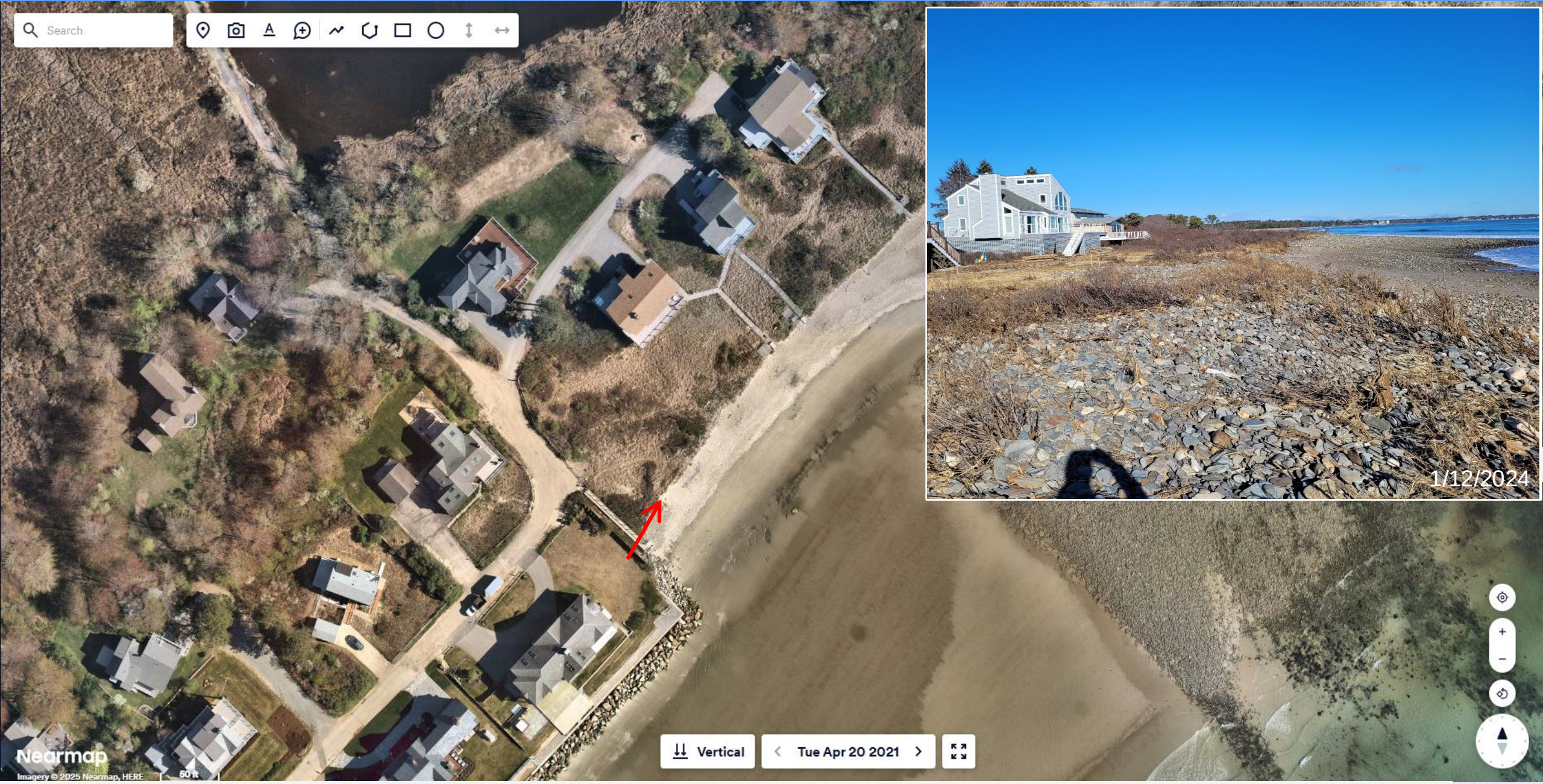
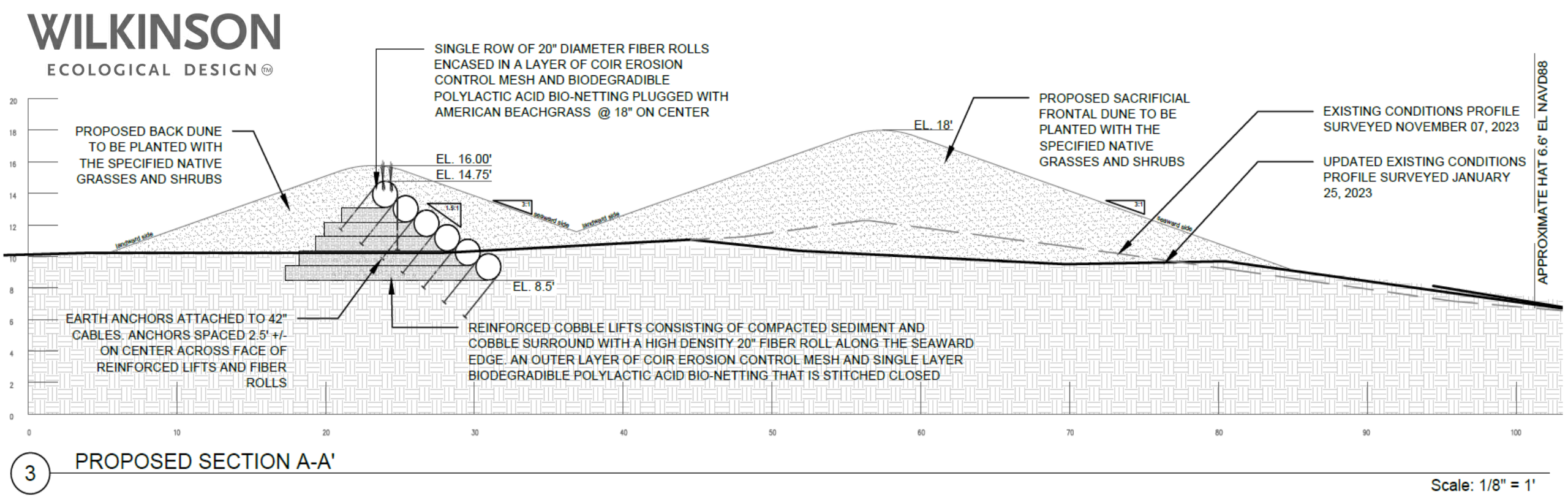
Case study Locations



Location: Laudholm Beach, at the end of Drakes Island Beach, Wells

The Problem: Long-term end-effect erosion of an adjacent natural dune system caused by seawalls



3 PROPOSED SECTION A-A'

Scale: 1/8" = 1'

Solution: Use harbor dredge sediment to construct a combination sacrificial and secondary dune ridge. "Sacrificial" dune exceeds the FEMA BFE by 3 ft and a secondary dune ridge by 1 ft. Secondary ridge uses a cobble lift/fiber roll core anchored with duckbill anchors (permitted since this is a cobble-dominated beach). Plantings include dune grass and bayberry shrubs. *This is the first dune restoration project in Maine to utilize an "enhanced" core.*

Permits: A Maine DEP Individual Permit was needed for the dune project. Because it was above the HAT, no USACE permit needed.

Cost: comparable to rip-rap shoreline.

Monitoring: drone imagery and topographic monitoring for 5 years.


V. Beaulieu, Wells Reserve, 12-2,2024
GEOLOGY

V. Beaulieu, Wells Reserve, 12-16,2024 -

GEOLOGY

Location: Popham Beach State Park, Phippsburg
Problem: Episodic erosion from river migration and dune loss from storm-induced erosion

Solution: Demonstration project placing rows of holiday trees to trap sand and rebuild beach elevation and dunes.
Permits: a Maine DEP Solid Waste Permit and Maine DEP Permit-by-Rule were needed.
Cost: trees were donated; staff and equipment time
Monitoring: 2 years, annual photographs from same location

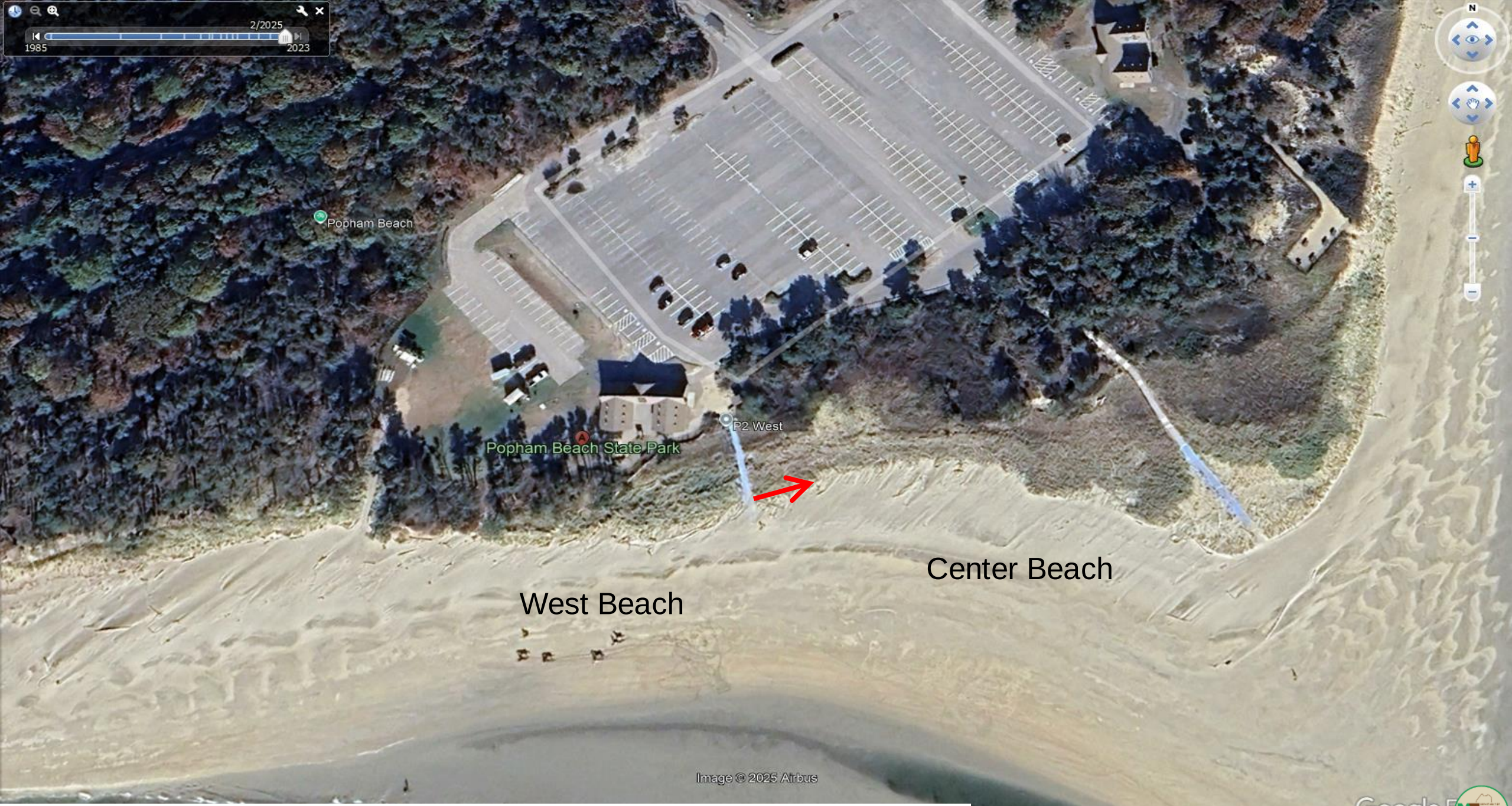


Photo documentation of project along Center Beach (3/2024-12/2024)

P. Slovinsky, MGS

Looking east, 3-22-2024

P. Slovinsky, MGS

Looking east, 3-25-2024

P. Slovinsky, MGS

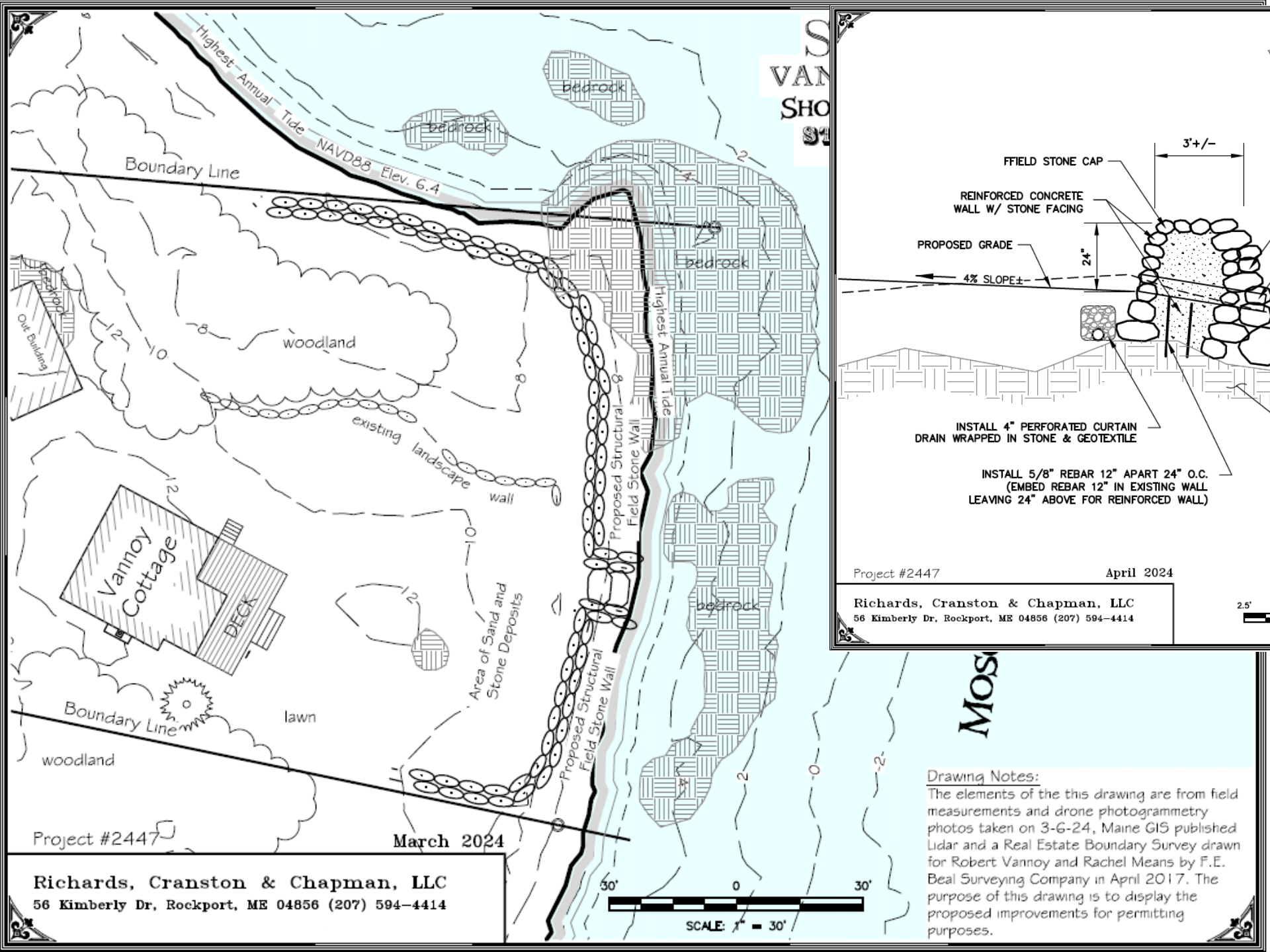
Looking east, 5-3-2024


P. Slovinsky, MGS
Looking east, 10-13-2024
GEOLOGY


S. Vaillancourt, BPL
Looking east, 12-3-2024
GEOLOGY

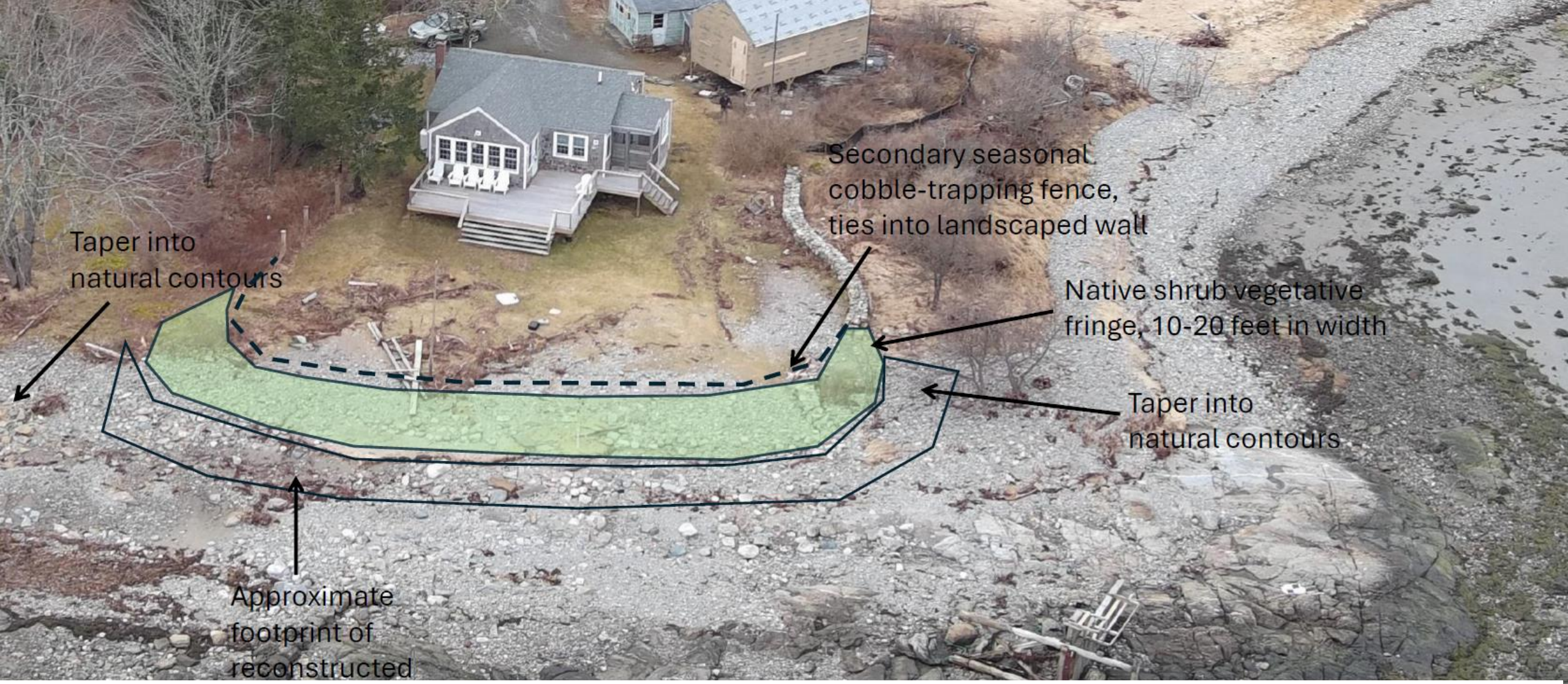
Location: St. George cobble dune system

Problem: Storm-induced washover of cobbles and potential erosion and flooding of property

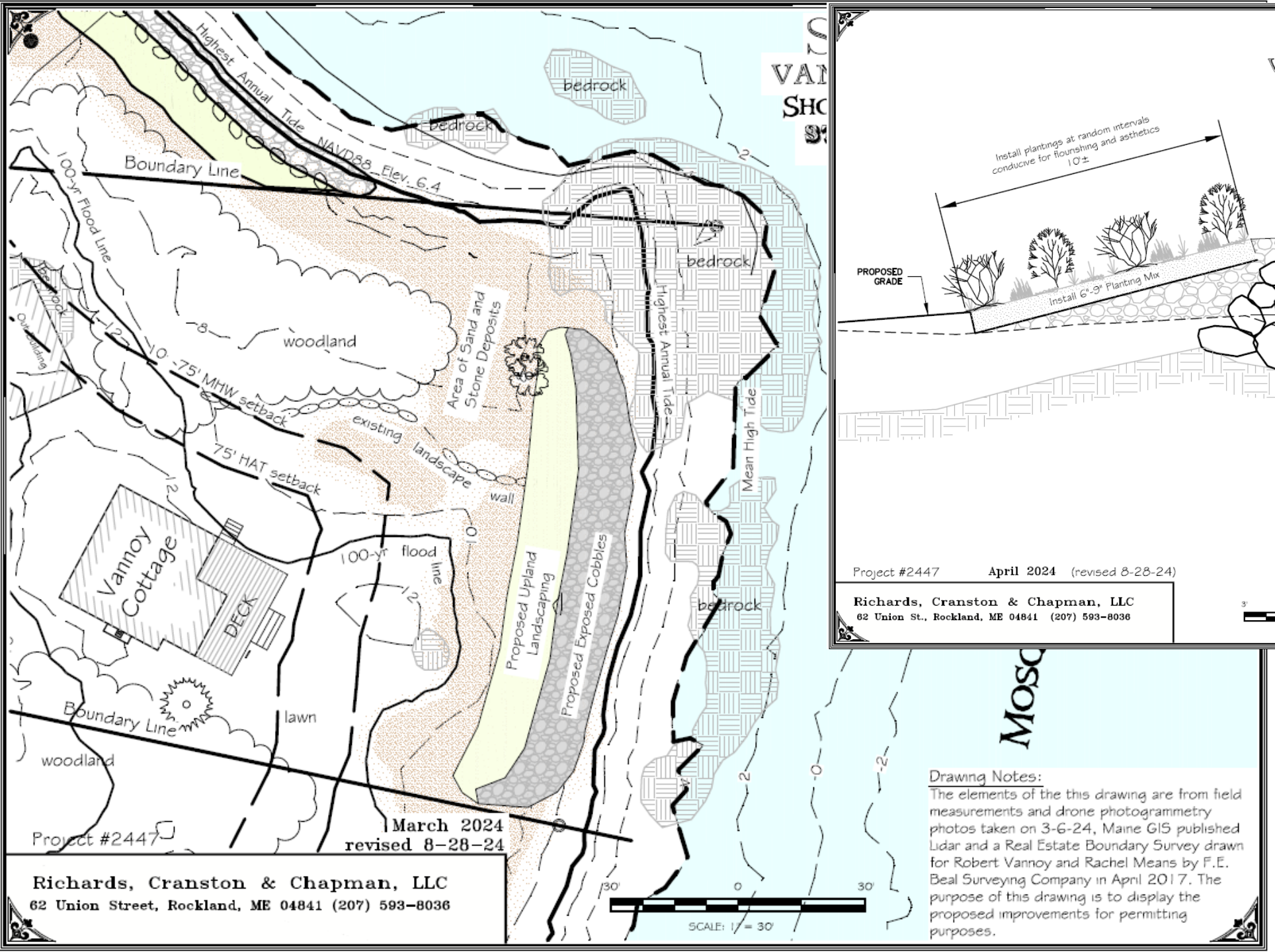


Original proposal

Vertical wall comprised of a reinforced concrete center and pinned field stones.



Solution: MGS suggested a restored a cobble dune using larger (D75) field stones as a “core” that tapered into natural contours on the site, and shrub plantings and a cobble trapping fence landward.
Permits: Maine DEP Individual Permit (but could be permitted under PBR now)
Cost: less than full rip-rap proposal
Monitoring: 85% vegetation planting success for several years.

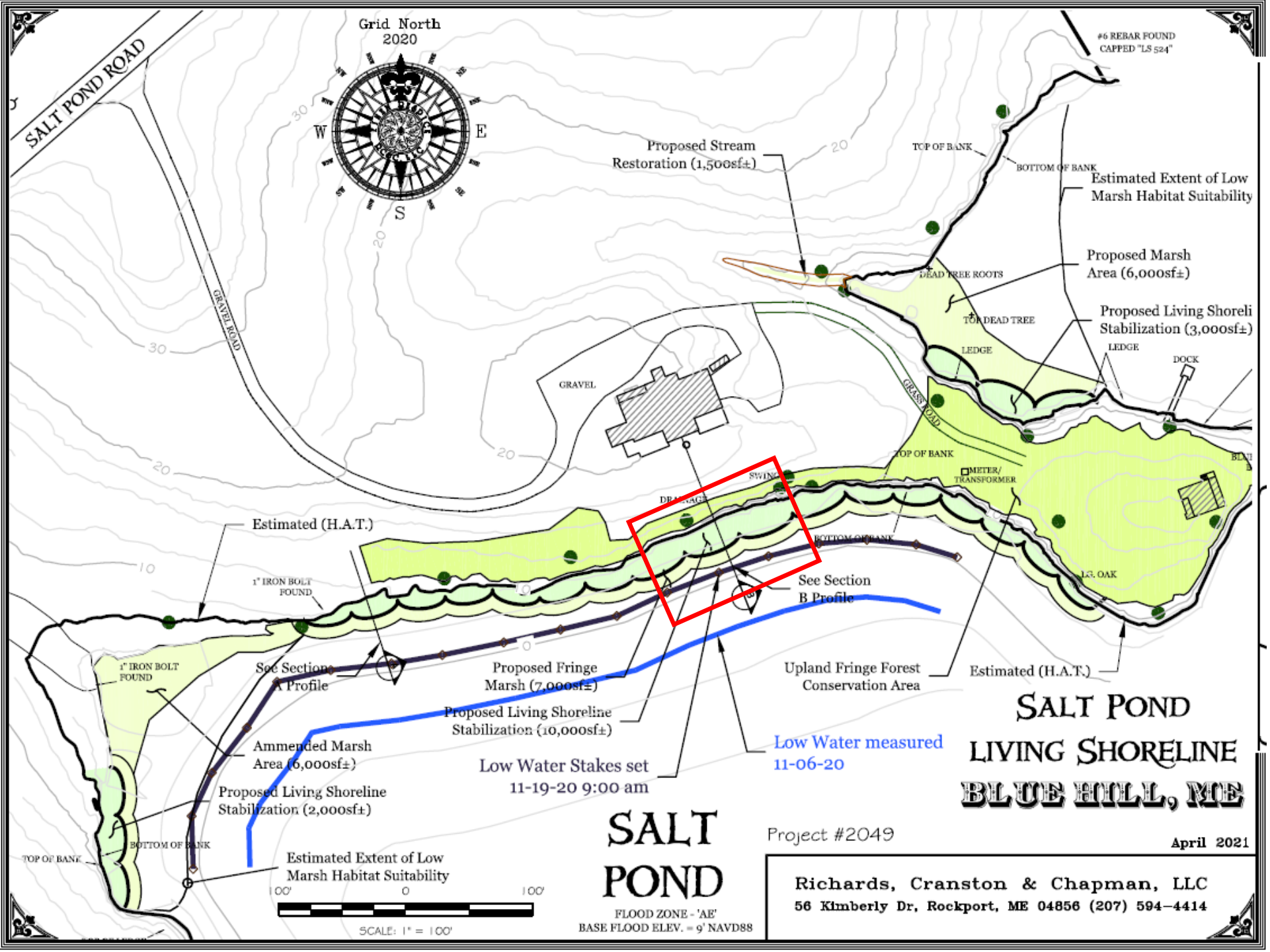


Final proposal

Field stone-core dune with natural cobbles and a 10-foot wide swath of native shrubs

Location: Salt Pond, Blue Hill

Problem: eroding and undermined bluffs, falling trees, poor upland land management



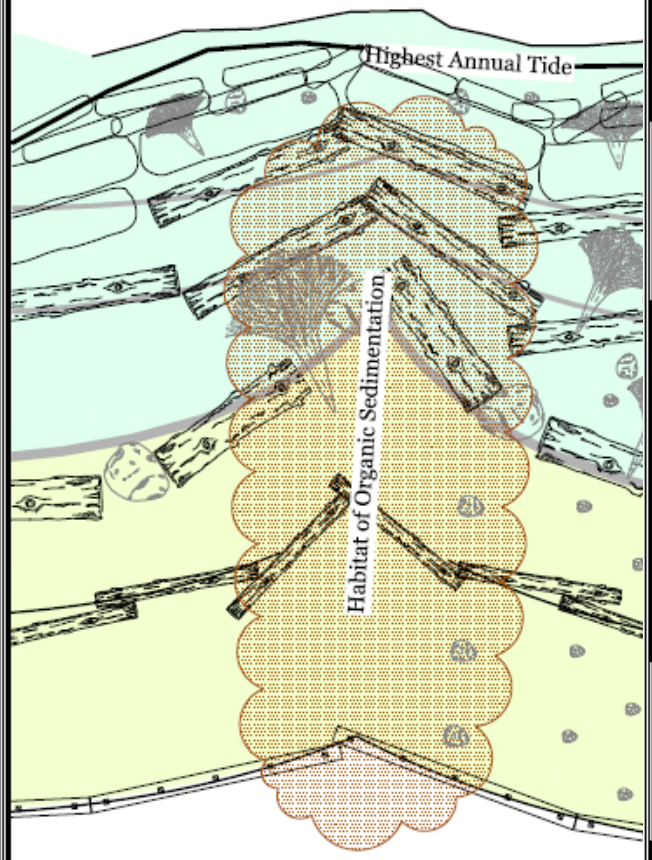
Solution: a tiered living shoreline design that included marsh restoration, tidal stream restoration, tiered habitats, and a tiered bluff that beneficially reused fallen and hazard trees.

Permits: USACE Individual Permit, MEDEP Individual Permit (marsh restoration offset any coastal wetland fill requirements)

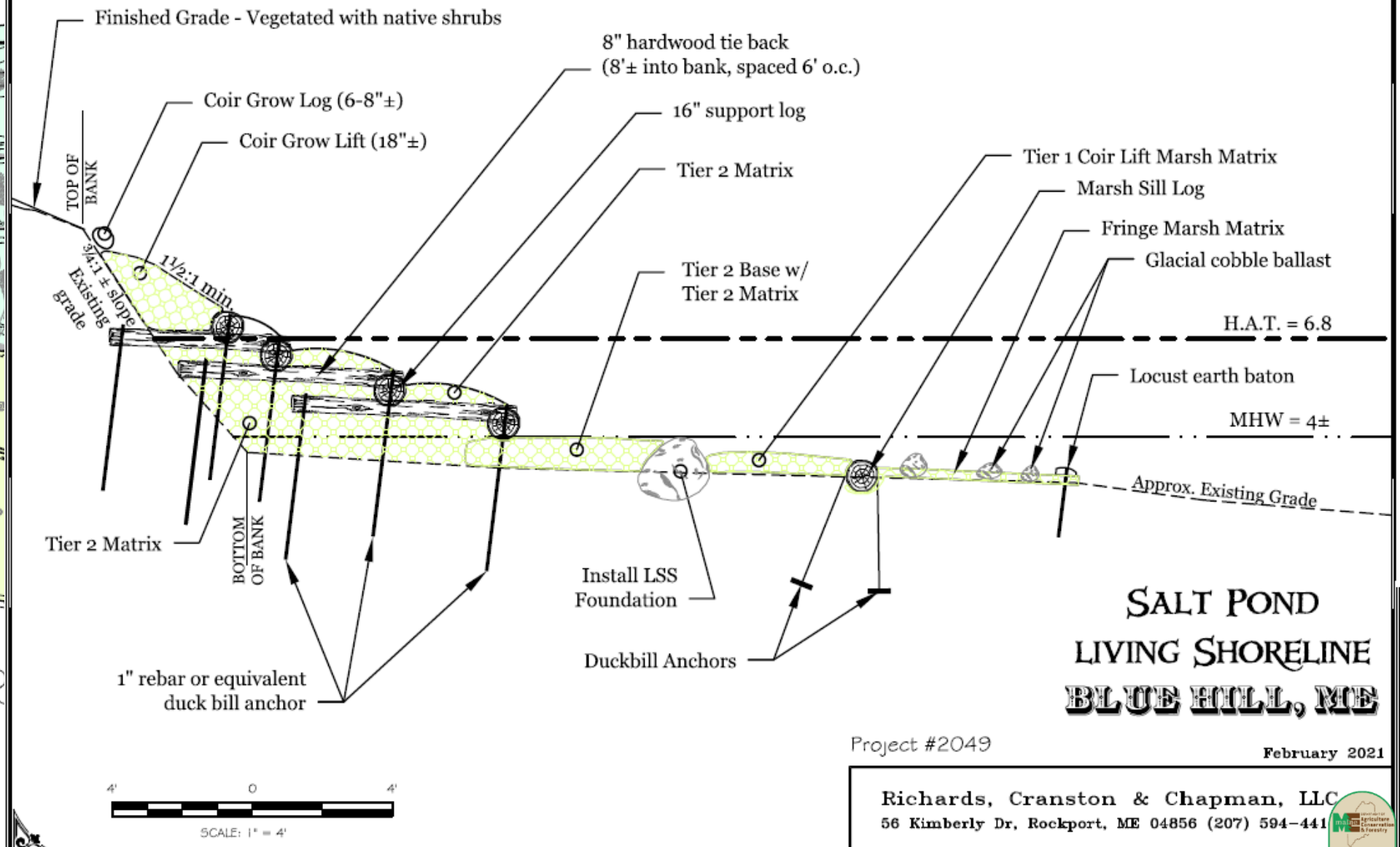
Cost: comparable to rip-rap shoreline

Monitoring: 5 years, annual surveys of vegetative plantings

NORRIS UPLAN



SALT POND LIVING SHORELINE BLUE HILL, ME



SALT POND LIVING SHORELINE BLUE HILL, ME

Project #2049

February 2021

Richards, Cranston & Chapman, LLC
56 Kimberly Dr, Rockport, ME 04856 (207) 594-441

GEOLOGY


4/2024
1985
2024
Stream restoration, fringe marsh, regraded and planted bluff
Image © 2025 Airbus
Google E
1985
Imagery Date: 4/21/2024 44°21'30.81" N 68°34'41.11" W elev 48 ft eye alt 10
GEOLOGY

Stream restoration and marsh restoration to tiered bluff


4/2024
1985
2024
Salt Pond Rd
172
Marsh restoration transitioning to tiered bluff
Image © 2025 Airbus
Google E
1985
Imagery Date: 4/21/2024 44°21'30.81" N 68°34'41.11" W elev 48 ft eye alt 10
GEOLOGY

Marsh restoration to tiered bluff

Marsh restoration to tiered bluff

P. Slovinsky, MGS

Coastal Bluffs Resources (CCSWCD)
https://www.cumberlandswcd.org/documents-1/coastal-bluffs

Coastal Property Owner's Guide (MGS)
https://digitalmaine.com/mgs_publications/605/

Living Shoreline Decision Support Tool (MGS)
https://www.maine.gov/dacf/mgs/hazards/living_shoreline/index.shtml

Living Shorelines in New England (TNC)
https://www.conservationgateway.org/ConservationPractices/Marine/Pages/new-england-living-shorelines.aspx

Living Shoreline Pilot Project Case Studies (TNC)
https://www.nature.org/en-us/what-we-do/our-priorities/protect-water-and-land/land-and-water-stories/northeast-living-shorelines/

Thank you!

Getting Out of Harm's Way

Jessica Brunacini, PhD
Coastal Training Program Director
Wells National Estuarine Research Reserve

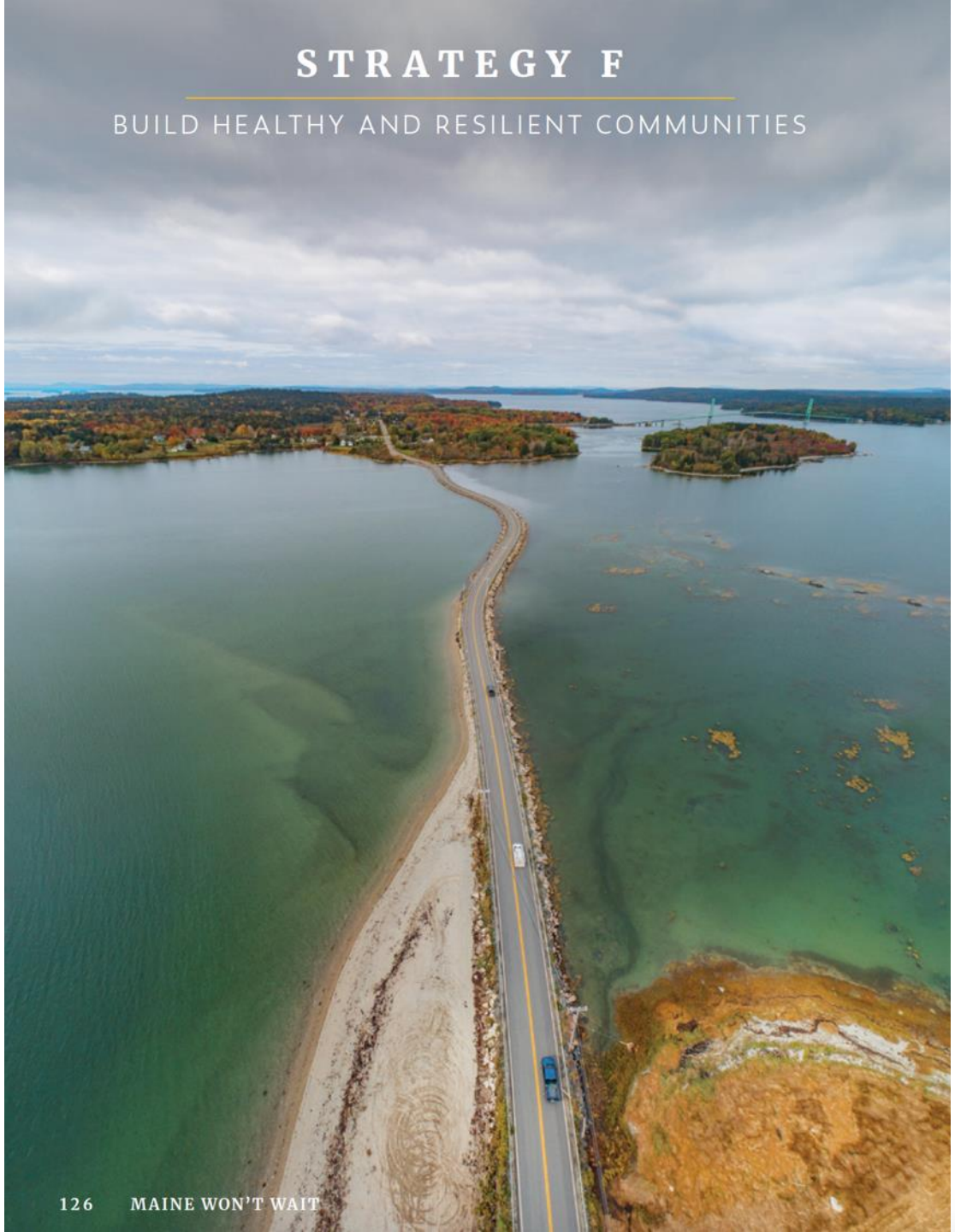
Spectrum of Nature-Based Strategies

Strategy	Protect	Accommodate	Avoid	Retreat
Example Approach	Building an engineered dune to keep water away from homes	Elevating buildings and infrastructure to allow higher water levels to pass through	Putting land into conservation to prevent new development or redevelopment in increasingly hazardous areas	Relocating critical infrastructure to higher ground to prevent inundation

A Quick Note About Language of Retreat

- Retreat
  - *Managed* Retreat
- Relocation
  - *Proactive* or *Planned* Relocation
  - *Community-Driven* or *Community-Led* Relocation
- Realignment
- Site Expansion
- Climate Migration
- Resettlement
- Getting out of harm's way

Maine Won't Wait Climate Action Plan Update



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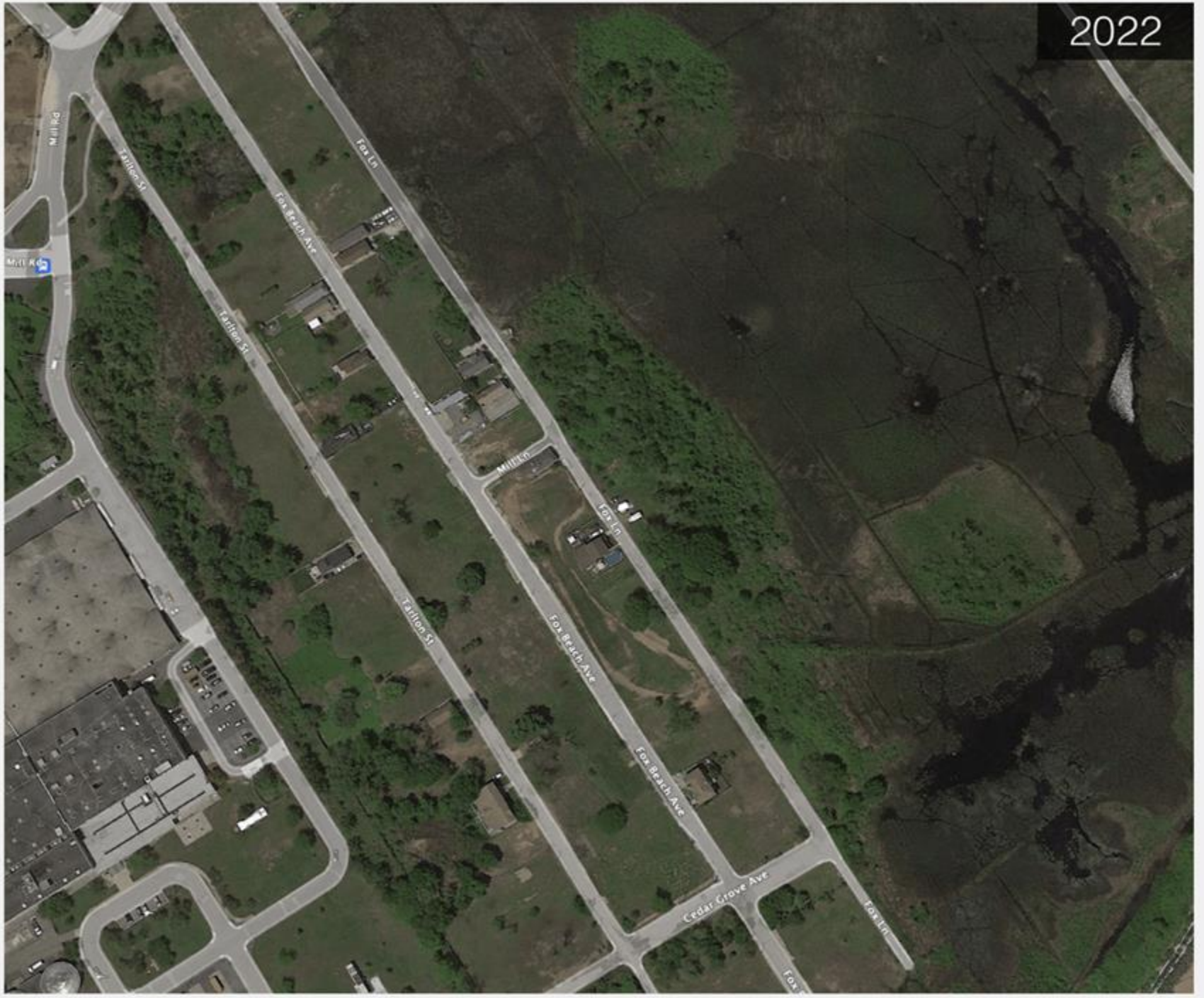
Increase local capacity for climate resilience

- Expand investment in grants and assistance to communities, so that by 2030, 80 percent of Maine communities are enrolled in the Community Resilience Partnership (CRP) and have received grants through the CRP or the Maine Infrastructure Adaptation Fund (MIAF).
- Help communities strengthen communication networks before, during, and after disasters, especially for people who traditional channels may not reach.
- Develop and share guidance with communities to help reduce the risks to development in areas vulnerable to wildfire, severe storms, extreme heat and cold, or other climate-related hazards, including tools to help communities and people "get out of harm's way."
- Increase local and regional capacity for management of storm debris and household hazardous wastes.

Oakwood Beach, Staten Island: Pre-Superstorm Sandy

Oakwood Beach, Staten Island: Post-Retreat



Dead ends in future for hazardous road that now crosses Spurwink Marsh

Cape Elizabeth and Scarborough plan to remove the portion of Sawyer Road/Sawyer Street that routinely floods during storms and is damaging marsh habitat.

Image credit:
Matt Craig

Wiscasset Approves Funds for First Phase of Wastewater Treatment Plant Relocation

December 8, 2024 at 8:00 am

Molly Rains

Wiscasset residents vote to allocate $353,750 from fund balance as a grant match toward phase one of the town's wastewater treatment plant relocation project during a special town meeting on Tuesday, Dec. 3. (Molly Rains photo)

Credit: Seth Wenig / AP Photo

Property Buyouts

Voluntary

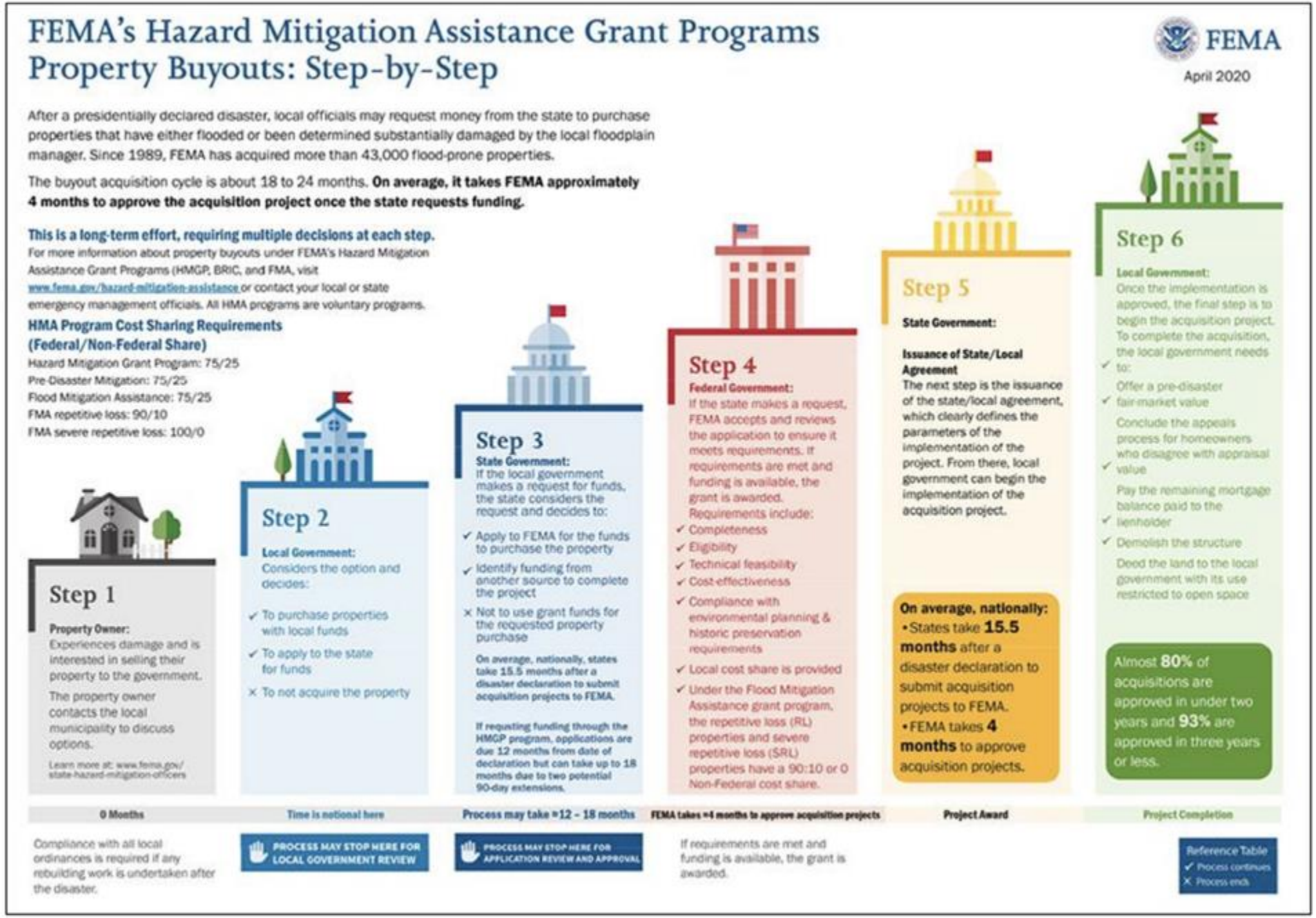
Funded by federal agencies, administered through states

FEMA, HUD, NRCS grant programs

Mix of post-disaster and pre-disaster programs

Homeowner’s primary residence

Land returned to natural, open space in perpetuity

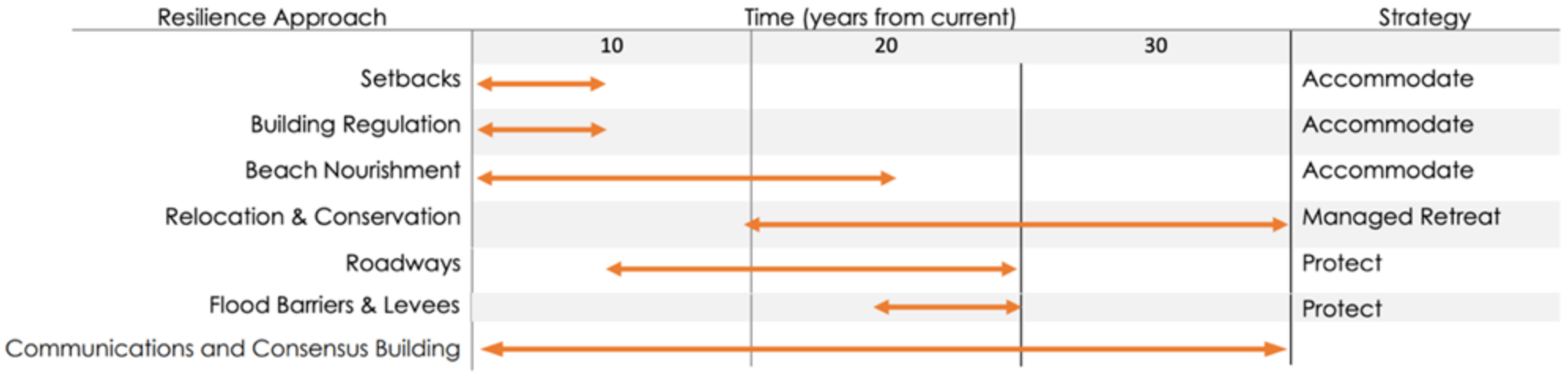


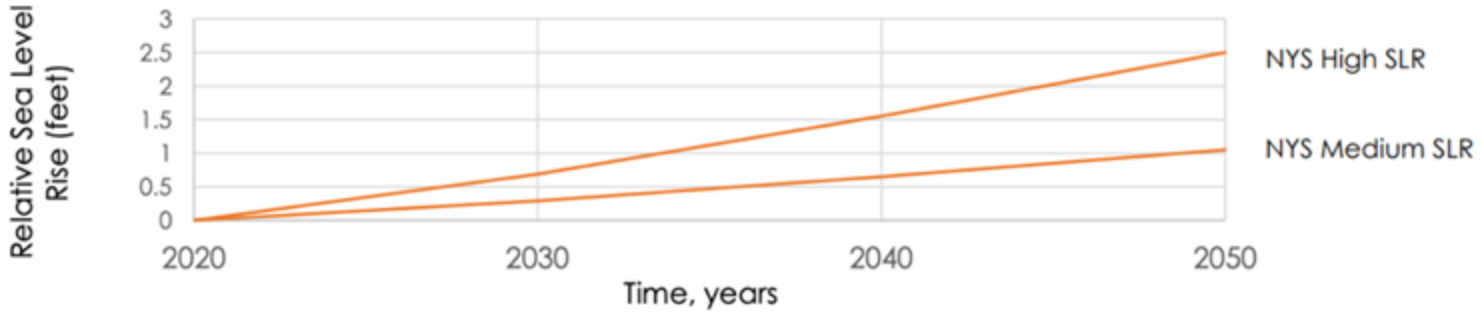
Source: Provided by FEMA to CRS, April 8, 2022.

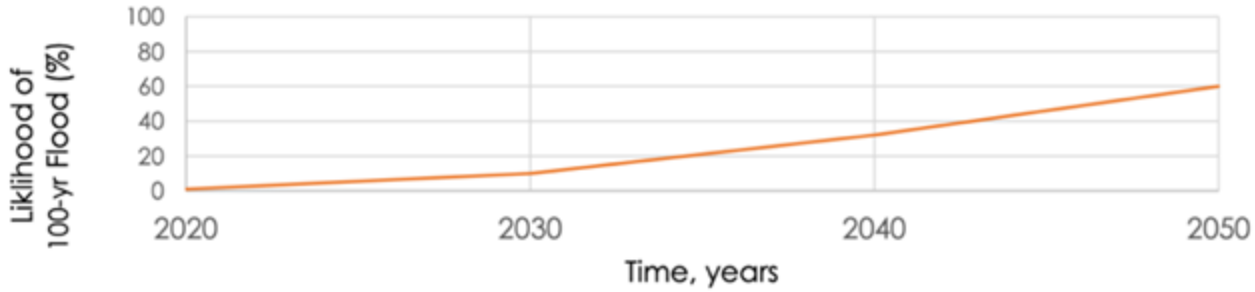
Maine Won't Wait Climate Action Plan Update Strategy F: Build Healthy and Resilient Communities

"Other potential tools could include **a voluntary "buyout" program** that pays property owners the market value of their property so they can move to a safer location when they decide that options like insurance or adapting in place no longer make sense. Such a program needs to **balance risk reduction with other potential local concerns** such as identifying safer areas, maintaining the sense of community, ensuring sufficient affordable housing, and impacts to municipal budgets." – pg. 131

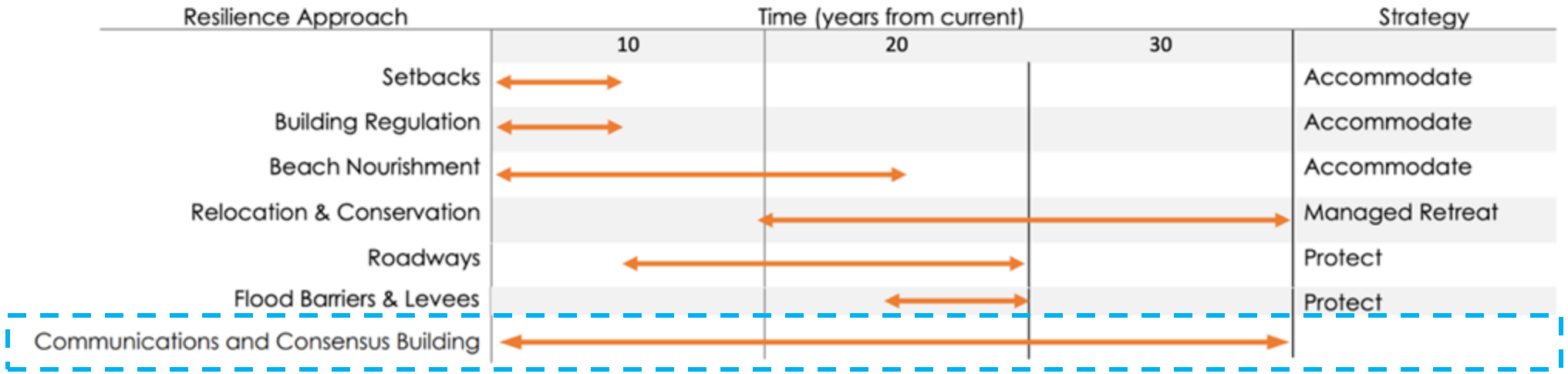
Town of East Hampton, NY Resilience Timeline

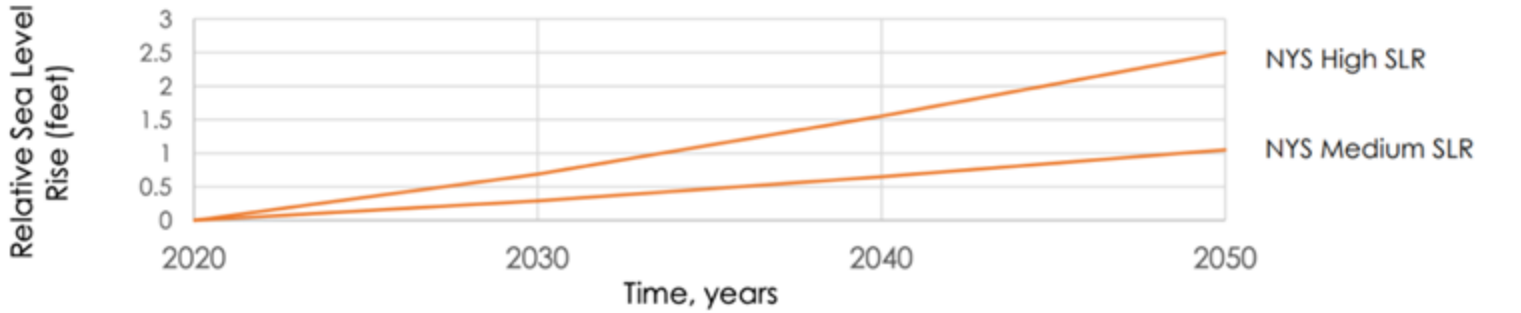


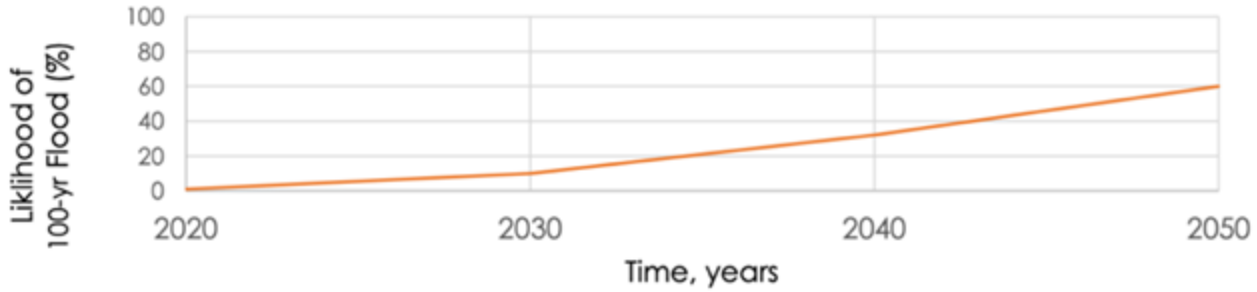




Town of East Hampton, NY Resilience Timeline

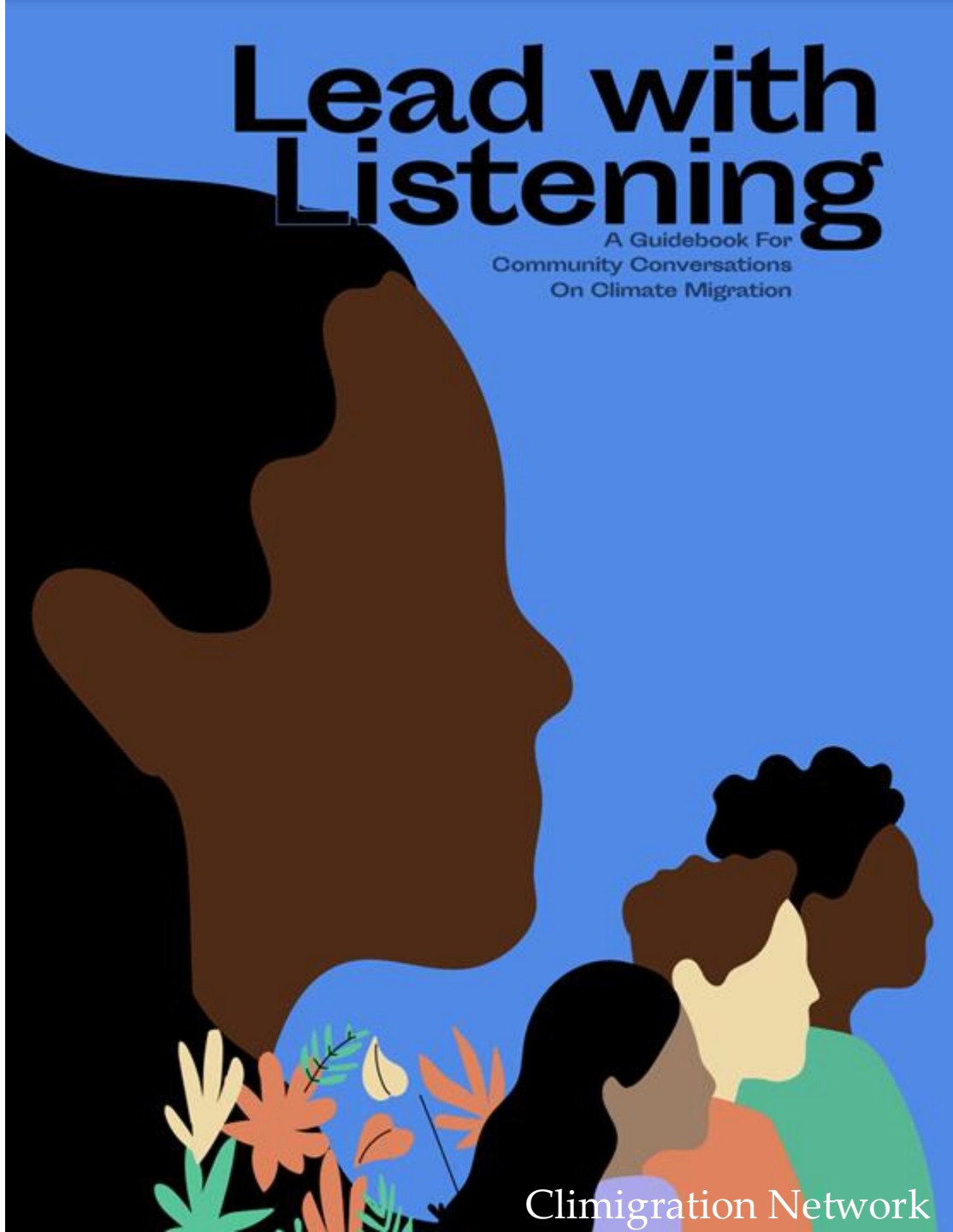






How do we talk about this?

-Center community members as experts
-Earn trust
-Consider culture, not just buildings
-Acknowledge trauma
-Speak to fear and anxiety
-Recognize power structures
-Use language that speaks to people's everyday lives



Who would lead these difficult conversations in Maine?

- Community leaders
- Engagement practitioners
- Facilitation experts
- Mental health professionals
- Social scientists

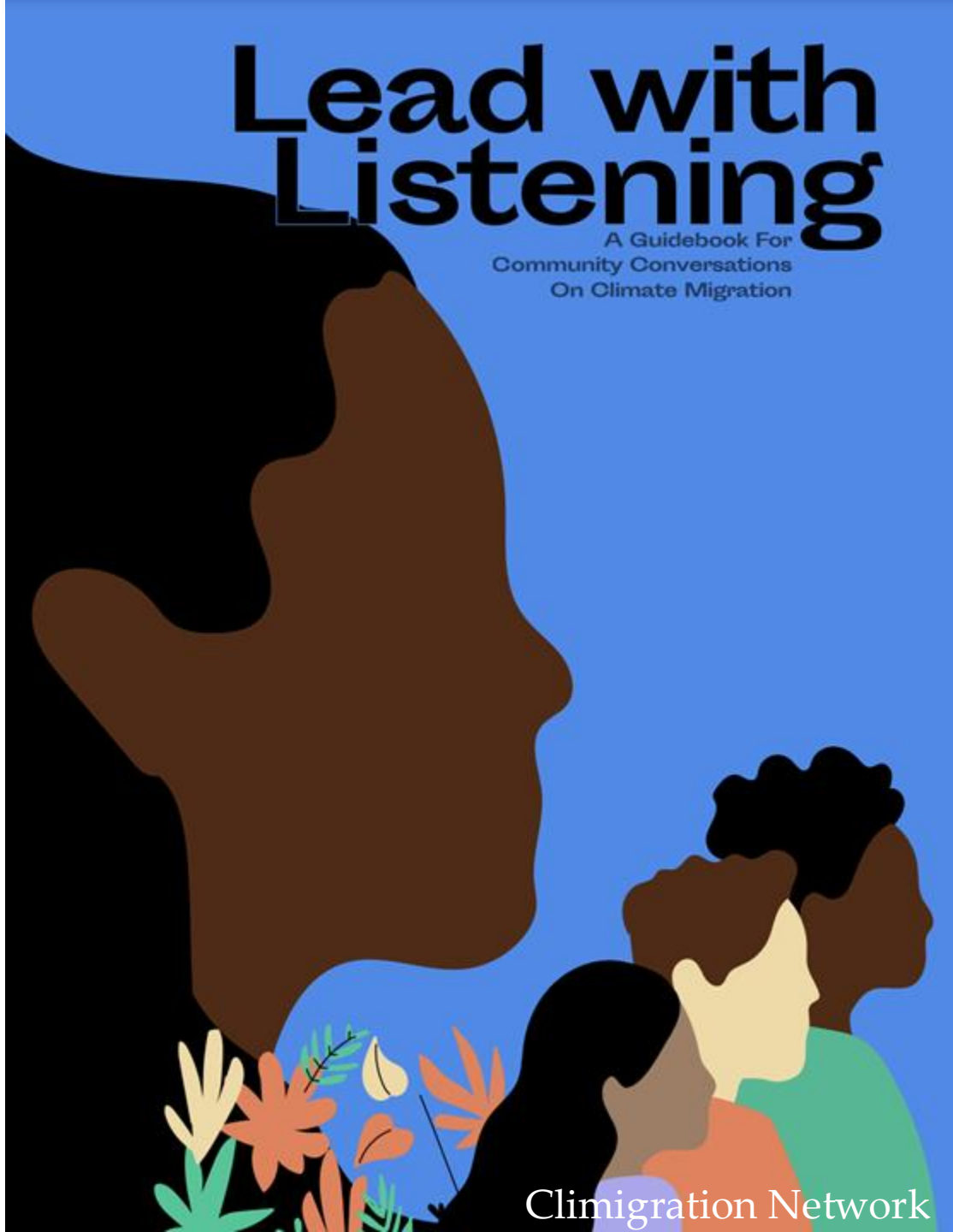



Image credit:
Alex MacLean

Thanks so much, and please feel free to reach out!

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